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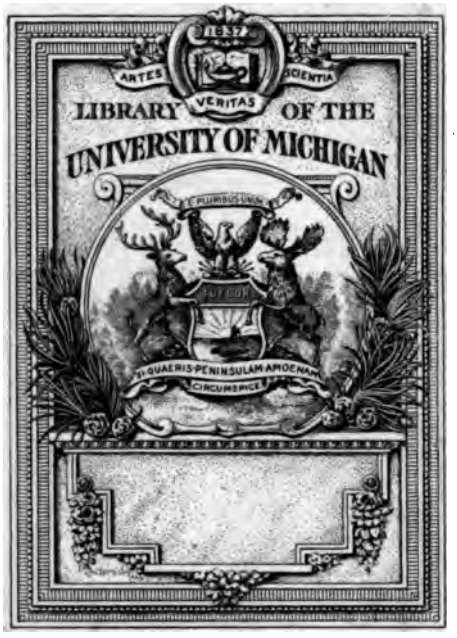
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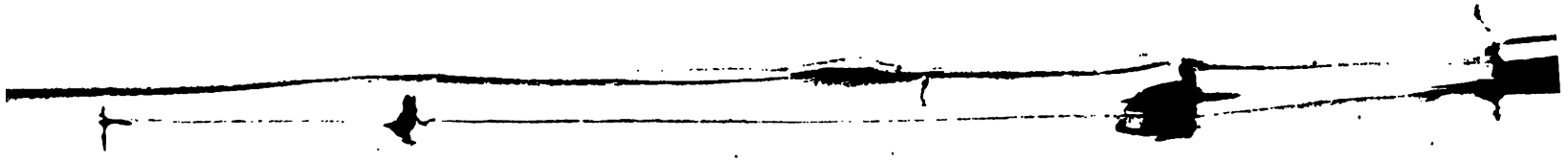
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ANNUAL REPORTS

OF THE

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WAR DEPARTME

FOR THE

FISCAL YEAR ENDED JUNE 30, 1902.

REPORT OF THE

CHIEF OF ENGINEERS.

PART 1.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1902.

ANNUAL REPORT

OF THE

CHIEF OF ENGINEERS,

UNITED STATES ARMY.

1902.



REPORT

OF

THE CHIEF OF ENGINEERS,

UNITED STATES ARMY.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, September 29, 1902.

SIR: I have the honor to present for your information the following report upon the duties and operations of the Engineer Department for the fiscal year ending June 30, 1902:

OFFICERS OF THE CORPS OF ENGINEERS.

The number of officers holding commissions in the Corps of Engineers, United States Army, at the end of the fiscal year was 150.

Since the last annual report the Corps of Engineers has lost one of its officers—Capt. James J. Meyler, who died on December 12, 1901.

There were added to the Corps of Engineers, by transfer from the line of the Army, three first lieutenants on March 7, 1902, and one on April 9, 1902, to date from January 18, 1902, with rank from February 3, 1901, and nine second lieutenants on March 7, 1902, to date from January 18, 1902, with rank from February 2, 1901, to fill original vacancies, under the provisions of section 22 of the act of Congress approved February 2, 1901, and by promotion of graduates of the Military Academy, 7 second lieutenants on June 30, 1902, to rank from June 12, 1902. Five of the second lieutenants transferred on March 7, 1902, were promoted to first lieutenants on March 10, 1902, to fill existing vacancies in the Corps of Engineers.

On the 30th of June, 1902, the officers were distributed as follows:

TABLE I.

Commanding the Corps of Engineers and Engineer Department, and Board of Ordnance and Fortification	1
Office of the Chief of Engineers and Light-House Board	1
Office of the Chief of Engineers	5
Division Engineer, fortifications, river and harbor works, and Light-House Board	1
Division Engineer and The Board of Engineers	1
Fortifications and river and harbor works	15
Division Engineer, river and harbor works, and The Board of Engineers	1
Division Engineer, river and harbor works, and light-house district	1
Division Engineer, Mississippi River Commission, Missouri River Commission, and light-house district	1

Division Engineer, river and harbor works, and engineer officer, Department of the Lakes	1
Division Engineer, California Débris Commission, and engineer officer, Department of California	1
Light-House Establishment	5
The Board of Engineers and International Congress	1
Washington Aqueduct	2
River and harbor works	13
Division Engineer, fortifications, river and harbor works, and California Débris Commission	1
River and harbor works and light-house districts	2
Fortifications and light-house district	1
Division Engineer, Mississippi River Commission, fortifications, and river and harbor works	1
Division of the Philippines	25
Missouri River Commission, fortifications, and river and harbor works	1
Fortifications, river and harbor works, and light-house districts	4
Post of Fort Leavenworth, First Battalion of Engineers, and engineer officer, Department of the Missouri	1
Post of Washington Barracks, Engineer School of Application, and Third Battalion of Engineers	15
Survey of Northern and Northwestern lakes	1
Mississippi River improvement	3
Mississippi River Commission, Missouri River Commission, and river and harbor works	1
Public buildings and grounds, District of Columbia	1
Engineer Commissioner, District of Columbia	1
Cuban affairs	2
Post of Washington Barracks and Engineer School of Application	2
Post of Fort Leavenworth and First Battalion of Engineers	14
River and harbor works, Yellowstone National Park, and Fort Washakie military road	1
Fortifications, river and harbor works, and Board of Ordnance and Fortification.	1
United States Military Academy	5
Assistants to Engineer Commissioner, District of Columbia	2
Fortifications, river and harbor works, and engineer officer, Department of Texas.	1
Mississippi River improvement, light-house district, river and harbor works, and Vicksburg National Military Park	1
Post of Washington Barracks, Engineer School of Application, and engineer officer, Department of the East	1
Buildings for Government Printing Office, War College, and Washington Barracks	2
California Débris Commission	1
Engineer depot at Willets Point and The Board of Engineers	1
Adjutant-General's Office, United States Army	1
Graduating leave	7
	150

As shown by the above table, the duties devolving upon the Corps of Engineers are greater now than ever before in its history, and year after year they have been increasing.

These duties now include the command of three battalions of troops, the expenditure of about $3,000,000 appropriated by Congress for fortifications and kindred work, of over $80,000,000 appropriated for river and harbor work; the construction and repair of the entire light-house system of the country; the water supply, the municipal engineering and a share in the city government of the capital of the United States the improvement of the Yellowstone National Park; the survey of the Northern and Northwestern lakes; and the mining and débris commission in the State of California. In addition, the Chief of Engineers ex officio a member of the War College Board, a member of the Board of Ordnance and Fortification, and of other important boards and commissions.

The act of February 2, 1901, increased the organization of the Corps of Engineers from 127 officers to 160, and the enlisted strength from one battalion to three battalions. The increase of officers was made up of 5 captains, 10 first lieutenants, and 18 second lieutenants.

The extra battalions of enlisted men called for continuous and exclusive services of the following officers, in addition to those serving with the original battalion:

Two majors, 8 captains, 12 first lieutenants, and 8 second lieutenants.

The following table shows the effect actually produced by the act above mentioned upon the number of officers of engineers available for the performance of their varied and important duties.

TABLE II.

Rank.	Increase of number of officers.	Increase of number of officers required for command of troops.	Gain as regards general duties of the corps.	Loss as regards general duties of the corps.
Majors		2		2
Captains	5	8		3
First lieutenants	10	12		2
Second lieutenants	18	8	10	
Total	33	30	10	7

The net result is the loss of 7 officers from the most effective grades for active control of works calling for severe physical exertion, and the gain of 10 officers in the grade of second lieutenant, who, by reason of youth and inexperience, must undergo a period of training and instruction before they become capable of assuming the responsibilities of independent commands.

A most serious effect of the reorganization of February 2, 1901, was to further materially reduce the already too slow rate of promotion for all officers hereafter joining the corps. From 1866 to 1901 the ratio of field officers in the Corps of Engineers to the total number was 39 per cent, which resulted in a satisfactory rate of promotion as compared with the Army at large; by the reorganization this ratio was reduced to 31 per cent, increasing materially the length of service required before reaching the grade of major. It is believed to be but simple justice that the numbers of the various grades be so readjusted as to return to the ratio of field officers in effect for thirty-five years, and that the field officers be proportioned among the grades of colonel, lieutenant-colonel, and major as nearly as practicable in the ratio adopted for the other staff corps, that is 1—1½—3, which would provide, without increasing the number of officers now authorized by law, the following organization, which is recommended: One brigadier-general, 12 colonels, 16 lieutenant-colonels, 34 majors, 40 captains, 40 first lieutenants, 17 second lieutenants.

At the present time there are 20 officers below the rank of major who have charge of very important engineering duties, including large river and harbor and fortification works; the many duties of the corps make the assignment of such junior officers to such positions unavoidable. The work performed, as well as length of service and experience, entitles these officers to the increased rank and emolu-

ments which a return to former ratios would partially grant. Experience in civil as well as in military life has long since proved the evil effect of imposing labors and responsibilities out of proportion to the amount of compensation paid for work to be done.

THE BOARD OF ENGINEERS.

The regulations for the government of the Corps of Engineers provide for a Board of Engineers, consisting of not less than three officers, designated by the Chief of Engineers with the sanction of the Secretary of War. This Board acts in an advisory capacity to the Chief of Engineers upon important questions of engineering. One of its principal duties is to plan or revise the projects for permanent fortifications of the United States.

Owing to the intimate relations in regard to defenses existing between the Corps of Engineers, the Ordnance Department, and the Artillery Corps, it was deemed expedient during the year to add an ordnance officer to the Board, in addition to the artillery officer added last year, for service whenever the preparation of plans of defense was under consideration. The actual detail was not made before July 1, 1902.

The composition of this Board and its operations during the past fiscal year are given in its report.

(See Appendix No. 1.)

BOARD ON TORPEDO SYSTEM.

This Board was dissolved during the year and its records sent to the artillery School of Submarine Defense at Willets Point. The transfer of the torpedo defenses to the artillery, by act of February 2, 1901, rendered the further continuance of the engineer board unnecessary.

FORTIFICATIONS.

The scheme of national defense upon which work has now been in progress since 1888 is based upon a report dated January 16, 1886, submitted by the Board on Fortifications or other Defenses, popularly known as the Endicott Board. This Board indicated the localities where defenses were most urgently needed; determined the character and general extent of the defenses, with their estimated cost; and recommended for first consideration the names of 27 principal ports, arranged in the order of their importance.

At the time of its report the coasts of the United States were undefended, except by obsolete ordnance mounted in old-style masonry forts incapable of coping even with the ships of that day; and the manufacture of armor and modern seacoast guns and carriages in the United States had not yet been entered upon or designs therefor perfected.

The first act of Congress designed to carry out the recommendations of the Endicott Board was approved September 22, 1888. It created the Board of Ordnance and Fortification and made appropriations for beginning the manufacture of modern seacoast ordnance, but made no provision for the construction of batteries. The first appropriation for the construction of gun and mortar batteries was contained in the act of August 18, 1890, since which time appropriations of varying amounts have been made regularly each year for carrying forward the

adopted scheme of coast defense—for the manufacture of ordnance, for the construction of batteries, and for torpedo defenses.

From time to time the defensive details for each locality have been carefully elaborated in projects prepared by The Board of Engineers, and in each case these projects have received the formal approval of the Secretary of War prior to the actual beginning of work. Up to the present time projects for permanent seacoast defenses have been adopted for 31 localities in the United States, as follows:

1. Penobscot River, Maine.
2. Kennebec River, Maine.
3. Portland, Me.
4. Portsmouth, N. H.
5. Boston, Mass.
6. New Bedford, Mass.
7. Narragansett Bay, Rhode Island.
8. Eastern entrance to Long Island Sound.
9. New York, N. Y.
10. Delaware River.
11. Baltimore, Md.
12. Washington, D. C.
13. Hampton Roads, Virginia.
14. Entrance to Chesapeake Bay at Cape Henry.
15. Wilmington, N. C.
16. Charleston, S. C.
17. Port Royal, S. C.
18. Savannah, Ga.
19. St. Johns River, Florida.
20. Key West, Fla.
21. Tampa Bay, Florida.
22. Pensacola, Fla.
23. Mobile, Ala.
24. New Orleans, La.
25. Sabine Pass, Tex.
26. Galveston, Tex.
27. San Diego, Cal.
28. San Francisco, Cal.
29. Columbia River, Oregon and Washington.
30. Puget Sound, Washington.
31. Lake Champlain.

In addition to the above localities, the defense of the Great Lakes and the St. Lawrence River is under consideration.

Projects for the defenses for Porto Rico, Hawaii, Guam, Manila, and Subig Bay have been approved by the Secretary of War, and actual construction should begin thereon at an early day. It is believed that the time has come when it will be no longer possible to ignore the question of the insular defenses. The Navy Department is properly insistent that all its important coaling stations should receive proper defensive protection to keep off predatory attacks from possible hostile fleets.

In view of modern changes in the methods of ordnance and ship construction, the degree of defense to be provided for coaling stations, scattered all over the world, for the larger naval bases which must be promptly established and for which appropriations are asked of Congress by the Navy Department, for the ports of Manila, Pearl Harbor, and Honolulu, and for the lake ports and the St. Lawrence River, should be determined by a tribunal similar to the Endicott Board. This tribunal should be created for the purpose by Congress, and, like the Endicott Board, should, it is suggested, include the Secretary of War, the chiefs of Engineers, Ordnance, and Artillery, one high ranking officer of each of those branches of the service, two naval officers of high rank, and two civilians expert on the subject of our foreign commercial relations.

Nearly fifteen years have elapsed since the adopted scheme of coast defense was formulated by the Endicott Board. At that time the rapid-fire gun was in its infancy, and ships were characterized by extremely heavy guns and great thickness of armor. With the development of the rapid-fire gun and the increase in the resisting powers of armor a material change has taken place in ship construction, necessitating corresponding changes in the details of coast defenses.

In accordance with the recommendations of the Endicott Board, the earlier detailed projects contemplated mounting a considerable number of the heaviest guns at the more important harbors in armored works. The tendency toward a reduction in caliber of heavy ordnance and the adoption of a disappearing carriage for the 12-inch gun has, up to the present time, enabled the United States to avoid costly experiments in armored turrets, cupolas, and casemates, which have been forced on European nations by their struggle for military and commercial supremacy. No definite numbers or calibers of rapid-fire guns were assigned in the earlier projects, but subsequent revisions have resulted in a regular programme for rapid-fire armament, a reduction in the number and caliber of heavy guns, a reduction in the number of mortars, and a general elimination of armored defenses. Marked economies have thus been secured without any sacrifice of defensive requirements. As ships and naval ordnance change, further revision will be necessary.

The first appropriation for constructing gun and mortar batteries was made in 1890, but it was not until 1896 that appropriations commensurate with the magnitude of the undertaking were made. The seacoast defenses of the United States are now somewhat more than 50 per cent completed; 25 of the principal harbors of the United States have a sufficient number of heavy guns and mortars mounted to permit an effective defense against naval attack, and during the past two years considerable progress has been made in the installation of an adequate rapid-fire armament, now the matter of first importance.

Gun and mortar batteries.—The existing projects for seacoast defenses comprise 356 heavy guns of 8-inch, 10-inch, and 12-inch calibers, 1,294 rapid-fire guns from 2.24-inch to 6-inch caliber, and 544 mortars. The total cost for the engineering work is estimated at $50,000,000, including what has been completed as well as what remains to be done.

Since the act of May 25, 1900, the wording of the fortification acts has not permitted the construction of any mortar batteries. During the summer of 1901 a series of tests was made by actual firing of the mortars in Fort Preble, Portland Harbor, Maine. The results were most satisfactory, and conclusively proved the usefulness of these pieces even against moving ships at ranges between 3,000 and 9,000 yards. Subsequent target practice has shown them to be accurate and effective up to 11,000 yards, and extreme ranges of 12,000 yards have been successfully used. The mortar possesses the advantage that it can be directed to hit any point within its limits of range. Intervening high or wooded land does not affect its searching fire if outlying range-finding stations are so provided as to permit the water areas to be seen. If an advanced gun battery is captured it can be instantly made untenable by mortar fire from any point within range. At most of the harbors all the mortars that are needed have been emplaced, but at a few localities additional mortar batteries are still essential. It is considered exceedingly desirable that future appropriation acts be so worded as to permit the expenditure of such limited funds as may be necessary in completing the provisions for mortar defense.

Since the inauguration of the present system of coast defense the several appropriations made by Congress for the construction of gun and mortar batteries have been as follows:

Act of—	
August 18, 1890	$1,221,000.00
February 24, 1891	750,000.00
July 23, 1892	500,000.00
February 18, 1893	50,000.00
August 1, 1894	500,000.00
March 2, 1895	500,000.00
June 6, 1896	2,400,000.00
March 3, 1897	3,841,333.00
Allotments from the appropriation for "National Defense," act of March 9, 1898	3,817,676.02
Act of—	
May 7, 1898	$3,000,000.00
July 7, 1898	2,562,000.00
March 3, 1899	1,000,000.00
May 25, 1900	2,000,000.00
March 1, 1901	1,615,000.00
June 6, 1902	2,000,000.00
Total	25,757,009.02

The foregoing table does not include $306,540.80 allotted and expended during the war with Spain from the appropriation for "National Defense" for the construction, on the Atlantic and Gulf coasts, of a number of earthen batteries which have since been abandoned; nor an appropriation of $992,000 for reconstruction and repair of the fortifications to protect the harbor of Galveston, Tex., made to replace the works injured or destroyed in the hurricane which wrecked the city of Galveston on September 8, 1900.

The total number of seacoast guns and carriages for which the Chief of Ordnance reports his Department has made provision, and the corresponding permanent emplacements for which the Engineer Department has made provision with the funds appropriated for construction of gun and mortar batteries, including allotments from the appropriation for "National Defense," are shown in the following table:

Type of gun or carriage.	Total carriages provided.	Total emplacements provided.
12-inch mortar carriages, model 1896	[a] 306	296
12-inch mortar carriages, model 1891	[b] 85	80
12-inch disappearing carriages, L. F., model 1901	11	11
12-inch disappearing carriages, L. F., model 1897	85	85
12-inch disappearing carriages, L. F., model 1896	27	27
12-inch gun-lift carriages, altered to nondisappearing	3	3
12-inch gun-lift carriages, model 1891	2	2
12-inch nondisappearing carriages, model 1892	[c] 28	27
10-inch disappearing carriages, A. R. F., model 1896	3	3
10-inch disappearing carriages, L. F., model 1901	8	8
10-inch disappearing carriages, L. F., model 1896	74	74
10-inch disappearing carriages, L. F., model 1894	35	35
10-inch nondisappearing carriages, model 1893	[d] 11	10
8-inch disappearing carriages, L. F., model 1896	38	40
8-inch disappearing carriages, L. F., model 1894	26	26
8-inch nondisappearing carriages, model 1892	[e] 9	[f] 9
15-inch smoothbore carriages altered for 8-inch rifles	21	[g] 21
6-inch disappearing carriages, model 1898	29	29
6-inch rapid-fire (Vickers Son & Maxim), pedestal mounts	8	8
6-inch, mount not determined upon	2	2
6-inch rapid-fire, pedestal mounts, model 1900	88	88
5-inch balanced-pillar mounts, model 1896	32	32
5-inch pedestal mounts	21	21
4.7-inch rapid-fire (Armstrong pattern), pedestal mounts	34	34
4.7-inch rapid-fire (Schneider pattern), pedestal mount	1	[h] 1
4-inch rapid-fire (Driggs-Schroeder), pedestal mounts	4	4
3-inch balanced-pillar mounts	118	118
3-inch casemate mounts	2	2
3-inch pedestal mounts	74	74
2.24-inch rapid-fire field carriages and rampart mounts	70	([i])

[a] The number of carriages of this type provided for exceeds by 10 the number which the Chief of Engineers has notified the Chief of Ordnance are required for the emplacements he has provided.
[b] One in use at West Point; four in storage.
[c] One in use at Sandy Hook Proving Ground.
[d] One at Sandy Hook Proving Ground.
[e] One at West Point and one at Sandy Hook Proving Ground.
[f] Five temporary; armament removed from 3.
[g] Temporary; armament removed from 16.
[h] Temporary.
[i] Movable mounts.

The foregoing table shows that up to the present time provision has been made for emplacing 331 heavy guns, 483 rapid-fire guns, and 376 12-inch mortars.

During the fiscal year just closed operations were carried on with unexpended balances of the appropriations carried by the regular fortification appropriation acts approved May 25, 1900, and March 1, 1901. The number of emplacements provided for under each of the foregoing acts is exhibited in previous annual reports. Under the fortification act of June 6, 1902, it is proposed to provide emplacements for the following number of guns:

12-inch.	10-inch.	6-inch.	15-pounder.
2	4	44	52

The total number of emplacements of every kind provided for to date by all appropriations is as follows:

12-inch.	10-inch.	8-inch.	Rapid-fire.	12-inch mortars.
105	130	96	483	376

In this total are included seventy 2.24-inch rapid-fire guns on movable mounts not requiring permanent emplacements; temporary emplacements for twenty-one 8-inch B. L. rifles on modified 15-inch carriages; one temporary emplacement for 4.7-inch rapid-fire gun, and five temporary emplacements for 8-inch guns on barbette carriages. The foregoing temporary emplacements were built during the war with Spain from the "National Defense" funds. The 8-inch guns will be transferred from time to time to permanent emplacements as these are completed, and a number of them have already been so transferred. While it is proposed eventually to disarm these temporary emplacements, they can again be used in case of emergency, and have for this reason been included in the foregoing enumerations.

The deficiency act of July 7, 1898, provided funds for mounting twenty-five each of 5-inch and 6-inch Brown segmental wire-wound rapid fire guns on navy-pattern mounts. Twenty-one emplacements for the 5-inch guns were completed before the contractors for the wire-wound guns and their carriages failed. No emplacements for the 6-inch guns were built, as the contractors never even completed the drawings for the guns. In the last fortification act Congress provided funds for the construction of twenty-one 5-inch rapid-fire guns to be mounted in these emplacements, and the Ordnance Department is now designing the guns and mounts to fit the emplacements which were built for the twenty-one wire-wound 5-inch guns.

The status of emplacements for which funds have been provided by Congress is as follows at the close of the fiscal year:

	12-inch.	10-inch.	8-inch.	Rapid-fire.	12-inch mortars.
Guns mounted	80	112	[a] 89	[b] 108	297
Ready for armament	16	3	5	[c] 229	55
Under construction	9	15	2	146	24
Total	105	130	94	483	376

[a] Nineteen of these, which had been mounted temporarily, have since been dismounted.
[b] One temporarily.
[c] Including seventy 6-pounders not requiring permanent emplacements.

At the close of the previous fiscal year there were reported mounted:

12-inch.	10-inch.	8-inch.	Rapid-fire.	12-inch mortars.
72	112	86	88	263

A comparison of the last two tables shows an addition during the year to the completed seacoast armament of eight 12-inch guns, three 8-inch guns, twenty rapid-fire guns, and thirty-four mortars.

At the beginning of the year all contract works authorized under act of June 6, 1896, had been completed, except the contract let on December 24, 1900, to L. L. Leach & Son, of Chicago, Ill., for the completion of a gun battery and a mortar battery at Key West, Fla. They had an extension of time and finally failed and their contract was annulled. This makes ten extensions of time and two annulments of contract at this one locality. The work will now be done by hired labor, the increase in cost, if any, being charged to the contractors' bondsmen, under the terms of the contract.

For continuing the work of construction of gun and mortar batteries in accordance with approved projects an estimate of $4,000,000 is submitted.

Dynamite batteries.—During the fiscal year the Secretary of War directed the sale of the obsolete dynamite guns, and no further reports upon dynamite batteries will be submitted.

Range and position finders.—During the year satisfactory progress has been made in systematizing the whole matter of fire control. The utmost harmony has existed between the Chief of Engineers, the Chief of Ordnance, the Chief Signal Officer, and the Chief of Artillery, all of whose departments are involved in the work. This Department has taken the position that as the fire control is a purely tactical problem, the space required in the observation rooms, the height and degree of protection against projectiles, and the relative order in which the various forts and batteries should be equipped are subjects for the Artillery Corps to determine; that the province of the Engineer Department is to construct the shelters, towers, electric ducts, etc.; and that the Signal Corps is to install the telephones, telautographs, and other means of electrical communication, the power and lighting current used in connection with the telautographs being supplied from the engineer plants installed in the batteries. The Chief of Ordnance, by law, supplies the range-finding instruments themselves. Where the stations are located on naturally high ground there has been no delay in the completion of the engineer work, but where high steel towers are called for, the condition of the steel market has been such as to prevent rapid work. In most cases the towers have to be erected at inaccessible localities, and the total cost of each is so small that large firms will not bid for their construction, while smaller firms can not secure the rolled steel shapes from the mills without long delays.

At the present time 9 fire commanders' and 45 battery commanders' stations have been completed and turned over to the troops for use and care; 12 fire commanders' and 30 battery commanders' stations are under construction.

A very extensive experimental system of position finding using long horizontal bases is now being installed at Pensacola by this Depart-

ment and the Signal Corps in accordance with the plans of Maj. G. N. Whistler, Artillery Corps, approved by the Chief of Artillery. As a result of these tests it may prove unnecessary to construct such a large number of high steel towers as was originally provided by the Board on Location of Position Finders, whose reports have been the basis on which all allotments for range-finder stations have, up to the present time, been made.

The appropriation of $325,000 for installation of range and position finders, made by act approved June 6, 1902, became available too late in the year to permit any work to be done before July 1, 1902. The total amount of this appropriation, and $325,000 in addition, will be needed to provide batteries already built with their fire-control stations, under present plans of the artillery.

Preservation and repair of fortifications.—Operations under this appropriation have been limited during the fiscal year to the preservation of engineer material in new batteries, and to the application of remedial measures for reducing the dampness in some magazines in the earlier works. The mechanical and electrical appliances in modern batteries demand unremitting attention to prevent deterioration and damage under the destructive influence of the moist sea air, and the limited annual appropriations, prior to the last act for preservation and repair of fortifications, did not suffice to meet the numerous needs of the ever-increasing number of batteries. The new works already constructed represent an expenditure of approximately $25,000,000 for engineering work alone. With the $300,000 provided by the act of June 6, 1902, for works of preservation and repair it will be possible to remedy many incipient leaks and other defects which should have received attention before, as well as to remove some of the faults of construction of the older works. It is strongly recommended that an appropriation of the same sum be again made this year, as the needs are great and the number of separate works requiring attention and care is constantly on the increase.

Supplies for seacoast defenses.—The acts of May 25, 1900, March 1, 1901, and June 6, 1902, each appropriated the sum of $25,000 for tools and electrical and engine supplies for use of the troops for maintaining and operating light and power plants in gun and mortar batteries. This is designed to enable the Engineer Department to meet the requirements of paragraph 382, Army Regulations, prescribing the articles which are to be supplied by the Engineer Department to the Coast Artillery for the service of the batteries. Requisitions are made directly upon the Chief of Engineers, and authorized articles are purchased and issued by the district officers with as little delay as possible. This system has proved satisfactory. As the number of plants in the hands of the artillery has been much increased during the past year an estimate of $35,000 is submitted for the same purpose for the next fiscal year.

Sea walls and embankments.—The act of May 25, 1900, appropriated $150,000 for a sea wall and filling in at Fort Caswell, N. C., based upon a special estimate to Congress as a result of an extraordinary storm tide on September 30, 1899, which broke over the reservation and did serious damage to the buildings and batteries. At the close of the preceding fiscal year the concrete wall was complete, and a contract for fill behind the wall had been let. The filling has been completed during the past fiscal year.

The act of March 1, 1901, appropriated $100,000 for the general

construction of sea walls and embankments. This appropriation has been applied to the construction of sea walls at fortifications for the defense of Narragansett Bay, the eastern entrance to Long Island Sound, New York Harbor, Baltimore, Md., Hampton Roads, Virginia, and New Orleans, La.

The act of June 6, 1902, appropriated $100,000 for the construction of sea walls and embankments, which has been applied to the construction of sea walls at fortifications for the defense of the eastern entrance to Long Island Sound, New York Harbor, Hampton Roads, Virginia, Tampa, Fla., Mobile, Ala., and San Diego, Cal.

Based upon reports of district engineer officers showing the necessity for their construction, an estimate of $160,000 is submitted for the construction of sea walls and embankments at a number of additional localities.

Sites.—During the past year negotiations have been continued for the acquisition of one site at Boston Harbor, one at Narragansett Bay, and one at Fort St. Philip, La.; the acquisition of one site at the mouth of the Kennebec River, one in Boston Harbor, one at Narragansett Bay, one at St. Johns River, Florida, one at San Diego, Cal., and one tract at New York Harbor was completed during the year. In addition, negotiations have been entered into for the acquisition of one site at Portland, Me.

A number of sites still remain to be acquired to carry out the approved projects of seacoast defenses, and an estimate of $2,000,000 is submitted to continue the work. The most important of the sites still to be acquired is the one at the southern entrance to New York Harbor, rendered necessary by the new deep-water entrance now under construction.

Submarine mines.—All torpedo material necessary for a quick and effective defense is now in store at each harbor for which torpedo defenses are at present projected. With few exceptions, all harbors are now equipped with torpedo storehouses, cable tanks, and mining casemates. Mining casemates and additional storage facilities are still required at several localities; an estimate of $100,000, to be expended under the Engineer Department, is submitted for their construction. The purchase of torpedo material proper, such as cables, cases, floating plant, etc., was by the act of June 6, 1902, assigned to the Artillery Corps, and the construction of the buildings, casemates, cable galleries, and cable tanks left with the Corps of Engineers.

By the Army reorganization act of February 2, 1901, the torpedo defense of the seacoast devolved upon the artillery troops. The material has been reported ready for transfer at all points except Boston, Mass., and Galveston, Tex.

Actual transfers have been made as follows:

Portland, Me., September 30, 1901.
Portsmouth, N. H., December 16, 1901.
New Bedford, Mass., November 15, 1901.
Narragansett Bay, November 15, 1901.
Eastern entrance to Long Island Sound, May 20, 1901.
Eastern entrance to New York Harbor, July, 1901.
Southern entrance to New York Harbor, May 6 and 14, 1901.
Delaware River, July 13, 1901.
Baltimore, Md., April 29, 1901.
Washington, D. C., July 24, 1901.
Hampton Roads, Virginia, December 31, 1901.
Wilmington, N. C., November 6, 1901.
Charleston, S. C., May 2, 1901.
Port Royal, S. C., July 26, 1901.
Savannah, Ga., June 29, 1901.
Key West, Fla., October 15, 1901.
Tampa, Fla., August 17, 1901.
Pensacola, Fla., May 27, 1901.
Mobile, Ala., June 15, 1901.
New Orleans, La., November 6, 1901.
San Diego, Cal., May 31, 1901.
Columbia River, April 30, 1901.

Searchlights and electrical connections.—The fortification appropriation act of March 1, 1901, appropriated $150,000 for the purchase and installation of searchlights for the defenses of New York Harbor. Under this appropriation work is well advanced. The act of June 6, 1902, appropriated $150,000 for the general installation of searchlights in seacoast defenses.

The construction of the national seacoast defenses has now reached a point where most of the heavy guns are in position, a considerable portion of the light rapid-fire emplacements and some of the rapid-fire guns are completed, and it is important to continue the systematic installation of searchlight apparatus for night defense. Experience in New York Harbor and elsewhere has shown that economy in installation and the keeping of the electric plants in good order in time of peace are promoted by habitually using the fortification plants for post illumination also. An estimate of $500,000 for searchlight installation is submitted, and is recommended for special consideration as one of the urgent needs of the defense at this stage of its progress.

The following brief summaries of the detailed reports of district officers give a concise statement of the work at each locality during the fiscal year:

Defenses of coast of Maine.—Officer in charge, Maj. Solomon W. Roessler, Corps of Engineers; assistant, Lieut. (now Captain) Charles W. Kutz, Corps of Engineers, until October 31, 1901; Division Engineer, Col. Charles R. Suter, Corps of Engineers.

Bar Harbor, Maine.—Two 8-inch converted rifles and two 10-inch smoothbore guns were mounted on temporary wooden platforms in 1898. These have been dismantled by the sale of the two smoothbore guns and one of the converted rifles, and by the transfer to other points of the rest of the material.

Penobscot River, Maine.—There is no modern armament at this point. The project for the defense of the place is under revision.

A fine example of the casemated type of forts is located on the Fort Knox reservation. A repointing of much of the masonry and a dampproof cover over the casemated portion of the fort will be required to preserve it from destruction by frost.

The submarine-mining material was overhauled during the year. It is stored in a new brick storehouse.

Kennebec River, Maine.—The fort contains one 8-inch B. L. rifle mounted on a 15-inch smoothbore carriage. Only urgent repairs have been made. The submarine-mining material is stored in a temporary wooden storehouse.

A tract of land of about 37 acres was purchased during the year to afford site for a modern armament. The cost of the land was $10,000.

Portland Harbor, Maine.—The defenses include two old works, one of which is used for a depot for submarine-mining material.

At the beginning of the fiscal year emplacements were completed for three 12-inch rifles on disappearing carriages, six 10-inch rifles on disappearing carriages, sixteen 12-inch mortars, five 8-inch guns on disappearing carriages, one 6-inch rapid-fire gun on pedestal mount, and three 3-inch rapid-fire guns on balanced-pillar mounts. All the guns were mounted and ready for service.

One emplacement for a 10-inch gun on disappearing carriage was completed, except a portion of one traverse, and the gun was mounted and ready for service.

Work was in progress on emplacements for four 12-inch guns on

disappearing carriages, three 8-inch guns on disappearing carriages, eight 12-inch mortars, two 6-inch guns on disappearing carriages, four 3-inch guns on balanced-pillar mounts, five position-finder stations, one light and power plant, and two mining casemates.

The following new works were begun: Emplacements for six 6-inch rapid-fire guns on pedestal mounts, two fire commanders' stations, one mining casemate, three 3-inch guns, and one peace storage magazine. Of works in progress at beginning of, and begun during, the fiscal year, one emplacement for 12-inch gun was completed, and the gun mounted during the year; one emplacement for 12-inch gun was completed ready for the carriage, which has not been delivered; the concrete and fill of two emplacements for 12-inch guns on disappearing carriages had nearly all been placed; emplacements for three 8-inch guns on disappearing carriages, and two 6-inch guns on disappearing carriages were completed, except as to roadway; water supply and electric conduit and wiring, and all the guns were mounted; two emplacements for 3-inch rapid-fire guns were completed awaiting guns; two emplacements for 3-inch rapid-fire guns were completed, except as to fill, roadway, and wiring, and the guns were mounted; one mining casemate and three position-finder stations were completed; one peace storage magazine was completed. The engine, boiler, and station switchboard of the power plant had been assembled, the power house completed, electric mains laid, and poles for post service placed.

(See Appendix 2 A.)

Defenses of Portsmouth, N. H.—Officer in charge, Capt. Harry Taylor, Corps of Engineers; assistant, Lieut. Robert R. Raymond, Corps of Engineers, until November 2, 1901; Division Engineer, Col. Charles R. Suter, Corps of Engineers.

The defenses of Portsmouth which have been wholly or partly completed are as follows:

Two 12-inch B. L. rifles, model 1895, on disappearing carriages, model 1897. The construction of this battery was begun during the past fiscal year. The excavation was completed, drains laid, forms partly made, and floors partly laid. A construction plant was installed. No armament is on hand.

Three 10-inch B. L. rifles, model 1895, on disappearing carriages, model 1896. This battery has been completed, and three carriages and two guns are mounted. The third gun is on hand. The electric plant is not installed. The battery was transferred to the artillery December 16, 1901. During the past fiscal year the battery was completed, the three carriages and two guns mounted.

Two 8-inch B. L. rifles, model 1888, on disappearing carriages, model 1894. This battery has been completed and the armament mounted. It was transferred to the artillery July 23, 1898. The electric plant is not installed. During the past fiscal year extensive repairs have been made.

A storehouse for submarine-mining material and a tank for the submarine cable have been built and transferred to the artillery, together with all property pertaining to the submarine-mine defense of the harbor.

In addition to the above modern works there are three of the old type works—one a masonry construction and two open barbettes.

ork is only partly completed, and the site of one of
rks is partly covered by the 12-inch emplacements
on.

(2 B.)

oston Harbor, Massachusetts.—Officer in charge, Capt.
Corps of Engineers; assistant, Lieut. Robert R. Ray-
Engineers, until November 2, 1901; Division Engineer,
Suter, Corps of Engineers.
of Boston which have been wholly or partly completed

B. L. rifles, model 1888, on disappearing carriages,
his battery has been completed, the armament mounted,
plant installed. It was transferred to the artillery
During the past fiscal year minor repairs were made.
B. L. rifles, model 1895, on disappearing carriages,
his battery has been completed, except part of the fill
masonry and grading and sodding. The armament
d and the electric plant installed. The final completion
as been delayed on account of settlement. The arma-
hands of the artillery. During the past fiscal year
ere made.
B. L. rifles on barbette carriages, model 1892. This
completed, the gun carriages mounted, and the electric
One rifle, model 1888, is on hand not mounted. The
nsferred to the artillery January 26, 1901. No work
battery during the past fiscal year.
B. L. rifles, model 1888, on disappearing carriages,
1896. This battery has been completed, the arma-
and the electric plant installed. It was transferred to
tober 21, 1899. During the past fiscal year repairs
its have been made.
B. L. rifles, model 1888, on disappearing carriages,
1896. This battery has been completed, the armament
e electric plant installed. It was transferred to the
r 21, 1899. During the past fiscal year repairs and
ave been made.
. L. rifle, model 1888, on disappearing carriage, model
tery has been completed, the armament mounted, and
nt installed. It was transferred to the artillery
9. During the past fiscal year minor repairs were

B. L. rifles, on disappearing carriages, model 1901.
nents of this battery are under construction; no
t been made for the fourth. During the past fiscal
or the construction has been erected, the excavation
mit the concrete work made, and the drainage syste
for furnishing the cement, sand, and broken sto

B. L. rifles, on disappearing carriages, model 18
as been completed, except sodding the parados,
ed, and the electric plant installed. The rifles are
ng the past fiscal year minor repairs were made.
pid-fire guns on pedestal mounts. This batter

been completed, except the floors, doors, and grading and sodding the parapet. At the beginning of the past fiscal year work had just commenced on this battery.

Two 6-inch rapid-fire guns on pedestal mounts. Work on this battery was begun during the past fiscal year. The excavation has been completed and the drainage system laid.

Two 5-inch guns on balanced-pillar mounts. This battery has been completed, the carriages mounted, and the electric plant installed. It was transferred to the artillery January 26, 1901. No guns are on hand. Nothing was done to this battery during the past fiscal year.

Two 5-inch guns on pedestal mounts. This battery, which was intended for wire-wound guns, has been completed. No guns or carriages are on hand. During the past fiscal year a very small amount of work finishing up this battery was done.

Two 4.7-inch Armstrong rapid-fire guns on pedestal mounts. This battery has been completed, the armament mounted, and the electric plant installed. It was transferred to the artillery October 21, 1899. No work was done on this battery during the past fiscal year.

Two 4-inch Driggs-Schroeder rapid-fire guns on Driggs-Schroeder mounts. This battery has been completed, the armament mounted, and the electric plant installed. It was transferred to the artillery June 12, 1900. No work was done on this battery during the past fiscal year.

Three 3-inch Driggs-Seabury rapid-fire guns on Driggs-Seabury mounts. This battery has been completed, the armament mounted, and the electric plant installed. It was transferred to the artillery June 12, 1900. During the past fiscal year minor repairs were made.

Two 3-inch Driggs-Seabury rapid-fire guns on Driggs-Seabury mounts. This battery has been completed, the armament mounted, and the electric plant installed. It was transferred to the artillery March 6, 1901. No work was done on this battery during the past fiscal year.

Four 3-inch rapid-fire guns on pedestal mounts. This battery has been completed, except the floors and doors. No armament is on hand. The entire work on this battery, except the excavation, was done during the past fiscal year.

Three 3-inch rapid-fire guns on pedestal mounts. Two emplacements in this battery have been entirely completed, and the third completed except hanging the doors. No armament is on hand. During the past fiscal year one of these emplacements was constructed.

Mortar battery for sixteen 12-inch B. L. rifled steel mortars on model-1891 carriages. This battery has been completed, the armament mounted, and the electric plant installed. It was transferred to the artillery September 2, 1896. During the past fiscal year extensive repairs have been made.

Mortar battery for sixteen 12-inch B. L. rifled steel mortars on model-1896 carriages. One-half of this battery has been completed, the armament mounted, and the electric plant, except a generator, installed. This half was transferred to the artillery January 15, 1902. During the past fiscal year the second half of the battery has been under construction. The masonry of the magazines was completed.

As auxiliaries to the above batteries, seven range-finder towers for depression range finders and two mining casemates have been built. One of the range-finder towers was transferred to the artillery October

24, 1900; one, November 19, 1900; and three, October 4, 1901. The other two are complete and ready for transfer. Both mining casemates are ready for transfer. During the past fiscal year minor repairs were made to some of the range-finder towers.

In addition to the above modern works there are three works of old type, one of which is used as a depot for torpedo material.

Storehouses for engineer property and tanks for storage of submarine-mining cable have been built.

Negotiations for the acquisition of an additional site were continued throughout the year. Most of the site has been acquired by purchase. The balance will be condemned.

A steam lighter for use in connection with the construction of the works of defense was built during the fiscal year.

(See Appendix 2 C.)

Defenses of southeast coast of Massachusetts and Rhode Island at New Bedford, Mass., and Newport, R. I.—Officer in charge, Maj. George W. Goethals, Corps of Engineers; assistant, Lieut. Robert R. Raymond, Corps of Engineers, until August 10, 1901; Division Engineer, Col. Charles R. Suter, Corps of Engineers.

The defenses include two permanent masonry works of old type, one of which is used in part by the garrison.

At the beginning of the fiscal year the following batteries for high-power guns were completed, or practically so: Two emplacements for 8-inch guns on disappearing carriages; one battery of sixteen, and one battery of eight, 12-inch mortars; one battery of two 10-inch guns on disappearing carriages; one battery of two 5-inch rapid-fire guns; one battery of two 4.7-inch rapid-fire guns; one battery of two 12-inch guns on nondisappearing carriages; two batteries of two 3-inch rapid-fire guns each; one battery of four 3-inch rapid-fire guns; one battery of three 10-inch guns on disappearing carriages; and one emplacement for 6-inch rapid-fire gun. In addition to the foregoing, three cable tanks for the storage of torpedo material, three mining casemates, two brick torpedo storehouses, and an electric plant for furnishing light and power had been completed, and two battery commanders' stations had been erected.

During the fiscal year the most important operations were as follows: The excavation for three emplacements for 12-inch guns on disappearing carriages was completed, and the greater part of the concrete was placed in two of the emplacements, and the foundation was ready for the walls in the third; the excavation for three 10-inch guns on disappearing carriages was completed and the walls carried to ceiling level; and two emplacements for 6-inch and two emplacements for 3-inch rapid-fire guns were practically completed. One of the torpedo storehouses was entirely completed and was transferred to the artillery, and the other completed with the exception of the track connecting it with the wharf; and one cable tank was entirely completed except the track to the storehouse. A stone wharf was completed. One electric plant was completed, and another was practically completed. One fire commander's station and one battery commander's station were completed with the exception of some minor details, and two stations were erected with roof and shutters of a temporary nature, which are to be replaced later with concrete and iron. A portion of the ducts for the fire-control system have been laid, and trenches have been dug for the remainder of the ducts.

Several magazines have been lined with brick and sheet copper to prevent dampness. A mining casemate was fully completed and has been transferred to the artillery, together with all torpedo material not previously transferred. A sea wall consisting of 160 linear feet of riprap granite and 1,115 linear feet of rubble masonry was built.

Negotiations were entered into for the acquisition of 38⅝ acres of land, and payment for 20½ acres of this area has been made.

Minor works of preservation and repair of fortifications have been carried on from time to time during the year as required.

(See Appendix 2 D.)

Defenses of eastern entrance to Long Island Sound and coast of Connecticut.—Officers in charge, Maj. Smith S. Leach, Corps of Engineers, until January 7, 1902, and Maj. Charles F. Powell, Corps of Engineers, since that date; assistant, Lieut. Edward H. Schulz, Corps of Engineers, until November 4, 1901; Division Engineer, Col. Charles R. Suter, Corps of Engineers.

The defenses of New London consist of two works of the old type, containing no modern armament, one of which is an open barbette work on the east side of the river, in charge of an ordnance sergeant; the other work is a masonry construction and earthwork on the west side of the river. The latter work was garrisoned during the year. The act of June 6, 1902, grants to the State of Connecticut the right, under stated conditions, to occupy, improve, and control the site of the former work for the purposes of a public park.

The defenses of the eastern entrance to Long Island Sound are the following:

Site No. 1 comprises one heavy and two rapid-fire batteries, which were transferred to the artillery February 18, 1901. Electric lighting is installed, also a steam-heating plant at the heavy battery. Two of the batteries are armed.

Site No. 2 comprises two heavy batteries and one rapid-fire battery, all of which were transferred to the artillery March 7, 1901. Electric lights and a steam-heating plant have been installed at the heavy batteries. The guns are mounted. A mortar battery was substantially completed, with electric and steam heating installations, during the year. Since then the armament has been mounted and the battery placed in the custody of the troops. Four position-finding stations of the high-site type were nearly completed. Further work at the dynamite-gun battery at this site has been permanently discontinued and authority given for the transfer of its steam and electric plant to the Engineer Department.

At site No. 3 two heavy batteries were transferred to the artillery May 12, 1900. The armament is mounted and electric plants installed. A position-finding station, low-site type, for one of these batteries, and a steam-heating plant for reducing wetness from condensation were completed during the last year. A position-finding station for the other battery and a fire commander's station, both of the low-site type, were nearly completed during the year. Work of preparation was done in connection with the proposed new rapid-fire battery.

At site No. 4 one heavy battery and one mortar battery, each with a position-finding station, were transferred to the artillery March 31, 1900, and March 4, 1901, respectively. The armaments are mounted and electric plants installed. Two rapid-fire batteries were transferred

to the artillery March 4 and 31, 1901; the guns are mounted and electric plants in place. An emplacement for a rapid-fire wire-wound gun was transferred to the artillery, with electric-lighting installation, March 4, 1901. A mining casemate has been built and was transferred to the artillery April 30, 1901. A fire commander's station of the high-site type was begun in April, 1902, and its early completion secured at the end of the year.

At site No. 5 an outwork with mining casemate and electric lighting was completed in 1900; no guns are mounted; part of the electric installation was removed for use elsewhere. The work is not garrisoned.

Extensive preparations at the defenses of the eastern entrance of Long Island Sound were made for the September (1902) Army and Navy maneuvers. These preparations included the provision of 20 searchlights of varying sizes, with their operating plants, the building of a number of horizontal-angle position-finding stations, and engineer work for telautograph and telephone services.

(See Appendix 2 E.)

Defenses of New York Harbor.—Officer in charge, Maj. William L. Marshall, Corps of Engineers; assistant, Lieut. William L. Guthrie, Corps of Engineers, since March 10, 1902; Division Engineers, Col. Charles R. Suter, Corps of Engineers, until July 24, 1901, and Col. Samuel M. Mansfield, Corps of Engineers, since that date.

Eastern entrance to New York Harbor.—At the beginning of the fiscal year emplacements had been completed and turned over to the artillery for the following guns and mortars: Two 8-inch, four 10-inch, and four 12-inch guns on disappearing carriages; twenty-four 12-inch B. L. mortars, six 5-inch rapid-fire guns (two not yet provided with guns), and four 3-inch rapid-fire guns.

Electric-lighting plants have been installed for all the heavier batteries, two range-finder stations have been built, and electric tide indicators have been installed.

Under recent allotment work was started upon four range-finder stations, but is temporarily suspended.

One thousand three hundred and eighty-nine linear feet of sea wall have been built, and further construction is in progress.

Emplacements for two 6-inch rapid-fire guns, addition to mining casemate, and extension to electric laboratory have been built and are practically completed.

Work is in progress on extension to museum building.

Southern entrance to harbor.—At the beginning of the fiscal year emplacements had been completed and turned over to the artillery for the following guns and mortars: Twenty-four 12-inch B. L. mortars; two 12-inch guns on nondisappearing carriages; two 12-inch guns on lifts; ten 12-inch guns, sixteen 10-inch guns, and five 8-inch guns, all on disappearing carriages; two 6-inch rapid-fire guns on disappearing carriages; two 6-inch guns on pedestal mounts; one 8-inch B. L. gun on modified 15-inch gun carriage; one 5-inch and four 4.7-inch rapid-fire guns; also one 4.7-inch rapid-fire gun in temporary emplacement; and the following structures: Three mining casemates, seven cable tanks, and two storage buildings for submarine-mining material, and fourteen range-finder stations. Electric tide indicators have been installed.

In addition there are eight emplacements for 3-inch rapid-fire guns completed. These emplacements have not been turned over to

the artillery owing to the fact that the base castings have not been received.

During the fiscal year the following work has been done: Four battery commanders' and one fire commander's stations have been completed and turned over to the artillery, and the following emplacements have been completed and are ready for transfer to the artillery: Four emplacements for 12-inch B. L. guns, and two emplacements for 6-inch rapid-fire guns on disappearing carriages. Three central electric-light and power plants have been installed, of which two are now ready for transfer to the artillery.

Six 36-inch, five 30-inch, and eleven 24-inch searchlight projectors, with cables and other accessories, have been contracted for and received.

Seven hundred and twenty-three linear feet of masonry and 480 linear feet of rubble wall have been built.

The following work is in progress: Two emplacements for 12-inch guns, about one-fourth completed; two emplacements for 12-inch guns, about one-half completed; peace storage magazine, brick work completed and ready for roof; and six emplacements for 6-inch rapid-fire guns, two are completed and four are nearly completed.

Under recent allotment, installation of a telautograph system was authorized. Cable has been ordered, but not yet received.

(See Appendix 2 F.)

Defenses of the Delaware River.—Officers in charge, Lieut. Col. Charles W. Raymond, Corps of Engineers, until October 1, 1901, and Col. Jared A. Smith, Corps of Engineers, since that date; assistant, Capt. Spencer Cosby, Corps of Engineers, until September 4, 1901.

The defenses include two masonry works of old type, one of which is in the charge of an ordnance sergeant. No new work is contemplated at this site. Modern batteries have been erected at the other site and were cared for by a small detachment of troops until November 18, 1901, when it was garrisoned. Modern works of defense are also located at two other points on the river, which are garrisoned.

At the beginning of the fiscal year the following batteries of modern type had been completed and turned over to the artillery: One battery for three 12-inch and three 10-inch guns on disappearing carriages; one battery for two 5-inch guns on balanced-pillar mounts; one battery for three 12-inch guns on disappearing carriages; one battery for two 4.7-inch rapid-fire guns on pedestal mounts; two batteries, each for two 3-inch rapid-fire guns on balanced-pillar mounts; one battery for two 8-inch guns on disappearing carriages, and two 12-inch guns on nondisappearing carriages; and one battery for sixteen 12-inch B. L. mortars. All of the guns in these batteries were mounted ready for service except two 5-inch rapid-fire guns and four 12-inch B. L. mortars, which were received during the fiscal year, and all mounted by the artillery except one 5-inch rapid-fire gun. Two batteries, each for two 5-inch rapid-fire guns on pedestal mounts, and one battery for two 3-inch rapid-fire guns on balanced-pillar mounts had also been completed and turned over to the artillery, but without armament.

The following works were completed and turned over to the artillery during the fiscal year: Two emplacements for 3-inch rapid-fire guns on casemate mounts and two battery commanders' stations.

At the close of the fiscal year the concrete foundation for one battery commander's station, low-site type, for 10-inch guns, had been

completed, and a contract awarded for the metal work of the tower, ready for erection, delivery to be made on or before October 1, 1902.

Plans and estimates had also been prepared for a battery commander's station for 12-inch guns.

All the submarine-mining material, which was inspected, tested, and put in good condition during the last fiscal year, was transferred to the artillery July 13, 1901. The steel lining for the cable tank, which was being placed at the end of the last fiscal year, was completed, and the cable replaced in the tank.

During the year, under various allotments from appropriations for "Preservation and Repair of Fortifications," repairs were made to battery slopes, sea walls, sluice gates, river banks, the drainage system of barbette of one masonry work of old type, and the interior face walls of the mortar battery. Rammer and stave supports were placed in one battery, six hoisting cranes on the platforms of another battery were moved to the other side of the platforms and the trolley rails for their ammunition service extended, and guards were placed over the gearing of the electric winches of the ammunition hoists.

Miscellaneous materials were purchased for the artillery on approved requisitions submitted by the acting engineer officers.

Under various allotments from the appropriation for "Supplies for Seacoast Defenses," electric lights for night drills were placed around the platforms of five emplacements for 12-inch guns, two for 8-inch guns, four for 3-inch rapid-fire guns and sixteen 12-inch B. L. mortars; repairs were made to the boiler of one electric plant; 800 feet of 2-inch water pipe were laid connecting one electric plant with the post water-supply system, and materials of various kinds were purchased on approved requisitions submitted by the acting engineer officers.

(See Appendix 2 G.)

Defenses of Baltimore, Md.—Officers in charge, Lieut. Col. Oswald H. Ernst, Corps of Engineers, until July 31, 1901, and Col. Peter C. Hains, Corps of Engineers, since that date.

There are four points occupied by modern forts in the system of defense, and another occupied by a work of the old type is used for garrison purposes.

At one site there were constructed and garrisoned at the beginning of the fiscal year a battery containing one 12-inch and three 8-inch B. L. rifles on disappearing carriages together with two 4.7-inch rapid-fire guns on pedestal mounts, and another battery containing two 3-inch rapid-fire guns on balanced-pillar mounts. The operations of the fiscal year have consisted in the construction of one mining casemate, the erection of a coal receptacle for the power plant, the partial dampproofing of the rooms and galleries of the main battery, which is still in progress, and the preservation and repair of the batteries and protecting sea wall.

At a second site there were already constructed and garrisoned at the beginning of the fiscal year two emplacements mounting two 12-inch B. L. rifles on barbette carriages; two emplacements for 5-inch rapid-fire guns with balanced-pillar mounts, without guns; and two emplacements containing two 3-inch rapid-fire guns on balanced-pillar mounts. During the year the remodeling of the old masonry work was completed, a battery commander's station nearly finished, and the whole fort put in good repair.

At a third site, the beginning of the fiscal year found completed and garrisoned one battery containing eight 12-inch B. L. mortars, one battery containing two 12-inch B. L. rifles on disappearing carriages, two emplacements for 5-inch rapid-fire guns with balanced-pillar carriages mounted, two emplacements for 6-inch B. L. rifles with disappearing carriages mounted, and four emplacements for 3-inch rapid-fire guns. The year's operations consisted in constructing a roadway between the eastern 3-inch and 12-inch batteries; in nearly completing two battery commanders' stations; in partially dampproofing the mortar battery, which work is still in progress; in continuing the construction of the sea walls and embankments; in raising two bases for Rafferty range finders; and in the preservation and repair of all the works at the reservation.

A fourth site contained two emplacements for 6-inch B. L. rifles with disappearing carriages mounted, and the work of the year has been to keep these in repair and to complete the sea wall.

In addition, electrical supplies have been furnished for all the electric installations, and an electrical expert was furnished the garrisons for use in connection with the submarine-mine defense, which had been turned over to the artillery April 29, 1901.

(See Appendix 2 H.)

Defenses of Washington, D. C.—Officer in charge, Lieut. Col. Charles J. Allen, Corps of Engineers. Officers in charge of Fort Foote Military Reservation, Md., Lieut. Col. Charles J. Allen, Corps of Engineers, until December 4, 1901, and Maj. William M. Black, Corps of Engineers, since that date.

At the close of the fiscal year 1902 there were completed emplacements for six 10-inch guns, three 8-inch guns, two 4-inch rapid-fire guns, two 6-inch guns on disappearing carriages, two 5-inch guns on balanced-pillar mounts, and eight 12-inch mortars. In addition there were under construction emplacements for five 3-inch rapid-fire guns on balanced-pillar mounts. The latter are completed with the exception of the platforms, which can not be finished until the mounts arrive.

The four battery commanders' stations pertaining to the approved system of fire control are completed.

During the past fiscal year an electric-light and power plant was installed in the 8-inch battery and an electric-light outfit placed in both the mortar battery and the 6-inch battery.

Necessary repairs were made to the batteries and buildings.

Some repairs to the wharf at Fort Foote, with an allotment of $50, have been made. Other minor repairs to wharf and roadway and to shore protection are needed.

(See Appendix 2 I.)

Defenses of Hampton Roads, Virginia.—Officer in charge, Maj. James B. Quinn, Corps of Engineers; Division Engineer, Col. Peter C. Hains, Corps of Engineers.

There are two old-type works at this point, on opposite sides of the channel. The fort on the north side of the channel is of earth and masonry, entirely surrounded by a moat, is garrisoned and has numerous modern emplacements exterior to the old work, only one high-power gun being emplaced within the enceinte.

The south fort is in an incomplete state, is without a garrison, and

has no armament, although work on one of the proposed rapid-fire batteries has been commenced, and a battery of two 6-inch rapid-fire guns authorized.

At the close of the fiscal year the modern armament of the north fort consisted of three 8-inch, eight 10-inch, and three 12-inch breech-loading rifles, sixteen 12-inch breech-loading mortars, and four 4.72-inch rapid-fire guns.

Emplacements for two 12-inch rifles and two 6-inch and four 3-inch rapid-fire guns are being built, the emplacements for the latter having been finished as far as possible before receipt of the armament.

Under the project for the fire-control system at the north fort, one fire commander's station and one battery commander's station have been erected and allotments have been made for one additional fire commander's and five battery commanders' stations, upon some of which work has been begun.

For the submarine-mine defense, two casemates and galleries, a cable-storage tank, and nearly all of the material for the defense have been provided at the north fort. All the structures and their equipment were turned over to the charge of the artillery December 31, 1901.

During the fiscal year 1902 work at the north fort consisted in the completion and loading of the foundation of the battery of two 12-inch guns. At the two 6-inch rapid-fire emplacements the concrete was placed to beam reference and a portion of sand cover provided. The foundations of three of the six towers to be erected have been finished and some work done on another. In addition to the above, work of minor importance has been done at the batteries not yet transferred. Two small structures for electric-lighting plants have been built, in one of which the generating set has been set up, and 333 feet of sea wall were built from the first jetty on the beach toward the engineer wharf, and 3,450 cubic yards of sand for fill behind same were placed. Such work as was required for the preservation and repair of the completed batteries was also performed.

At the south fort the site for the 3-inch gun battery has been filled with dimension stone to reference of concrete footing, and sheathing erected. A wharf has been built, derrick erected thereon, and hoisting apparatus for same set, and other plant provided for carrying on the work.

Plans for two 6-inch rapid-fire guns at the south fort, and a project for the extension of the sea wall toward Jetty No. 3 and for lining the damp magazines at the north fort, have been called for.

The armament of the north fort was increased by one 12-inch gun, which was mounted during the fiscal year by the artillery garrison.

(See Appendix 2 J.)

Defenses of the coast of North Carolina.—Officer in charge, Capt. Eugene W. Van C. Lucas, Corps of Engineers; Division Engineer, Col. Peter C. Hains, Corps of Engineers.

The defenses include the old-style Fort Macon and the modern batteries at the mouth of the Cape Fear River. The reservation at Southport, near the mouth of the Cape Fear River, has heretofore been included, but does not properly belong to the defenses of the Cape Fear River and hereafter will not be included in this report, the title to the land having been perfected at the expense of the appropriation

"For improving Cape Fear River, North Carolina," for which work it is now utilized.

At the beginning of the fiscal year the following works had been completed and turned over to the garrison: Emplacements for four 8-inch B. L. rifles; one emplacement for 5-inch rapid-fire gun, the last without carriage or gun; emplacements for two 12-inch B. L. rifles and for one 4.7-inch rapid-fire gun; and one central lighting and power plant. One battery of eight 12-inch mortars and one emplacement for 5-inch rapid-fire gun had been practically completed, but were not yet turned over.

During the year there have been transferred to the garrison one emplacement for 5-inch rapid-fire gun, the carriage having been mounted; one mining casemate; one torpedo storehouse; one cable tank; and one range-finding tower.

The mortar battery has not yet been transferred, but the settlement in the eastern pit has ceased, the work of releveling is nearly completed, and the battery will probably be transferred in the near future.

The range-finding tower (fire commander's station) was completed, ready for use, and on May 29, 1902, was transferred to the garrison. Some minor work of storing plant and clearing up around site remains to be done.

Emplacements for two 3-inch rapid-fire guns were completed during the year, but have not yet been transferred, as an emplacement for one 5-inch rapid-fire gun in the same battery has not yet been completed, pending the adoption by the Ordnance Department of an acceptable type of gun mount.

The low places inside the concrete sea wall have been filled to a level approximately 12 feet above mean low water, and work is now in progress restoring roads and railroads and planting grass to prevent blowing sand.

With allotment from appropriation for "Supplies for Seacoast Defenses," requisitions, approved by the Chief of Engineers, have from time to time been filled, and a contract has been entered into for rewiring two batteries, which work will be completed within the next few weeks.

With funds allotted from appropriation for "Preservation and Repair of Fortifications" general repairs have been made for maintenance of all emplacements, including drainage service, ammunition lifts, central lighting and power plant, pavements, submarine-mining outfit, and stoppage of leaks in concrete.

(See Appendix 2 K.)

Defenses of the coast of South Carolina.—Officer in charge, Capt. James C. Sanford, Corps of Engineers; assistant, Lieut. Edwin R. Stuart, Corps of Engineers, until August 15, 1901; Division Engineer, Col. Peter C. Hains, Corps of Engineers.

Charleston Harbor.—At the close of the fiscal year 1901 the defenses comprised the following works:

Mortar battery. Emplacements for sixteen 12-inch mortars are completed and mortars mounted.

Ten-inch battery. Emplacements for four 10-inch rifles on disappearing carriages are completed and guns mounted.

Six-inch rapid-fire battery. One emplacement for 6-inch rapid-fire gun on disappearing carriage is completed, and carriage installed.

One emplacement for 6-inch rapid-fire gun on pedestal mount is completed and gun mounted.

Emplacements for two 4.7-inch rapid-fire guns are completed and guns mounted.

Emplacements for three 3-inch rapid-fire guns on balanced-pillar mounts are completed.

Twelve-inch battery. Emplacements for one 12-inch B. L. rifle on disappearing carriage, and for one 12-inch B. L. rifle on barbette carriage are completed and guns mounted.

Part of the sloping wall in the southeast pit of the mortar battery was cut out and replaced by a wall of Portland cement concrete. A drainage ditch 1,200 feet long was dug and terra-cotta pipe laid in it.

At the end of the fiscal year 1902 the work of completing the earth slopes, wall, etc., of the 12-inch battery was well advanced. This consisted of removing old guns, cutting down and repairing the front wall, filling the hole in front of the battery, building up a portion of the south wall, paving the passage leading to the sally port and the platform just outside of the same, leveling off the parade, and cleaning up generally. The work on the front and south walls was completed, the filling about two-thirds completed, the old guns disposed of, and grading of parade partially completed.

A brick torpedo storehouse was built.

The wharves at two of the works were repaired.

Port Royal Sound, South Carolina.—At the close of the fiscal year 1901 the defenses comprised the following:

Emplacements for three 10-inch rifles on disappearing carriages completed and guns mounted.

Emplacements for two 4.7-inch rapid-fire guns completed and guns mounted.

During the fiscal year 1902 the torpedo material was transferred to the artillery and the engineer plant was moved to Charleston Harbor, South Carolina. No work was done on the dynamite battery, as it had been decided not to complete it.

(See Appendix 2 L.)

Defenses of the coast of Georgia and of Cumberland Sound, Georgia and Florida.—Officer in charge, Capt. Cassius E. Gillette, Corps of Engineers; Division Engineer, Col. Peter C. Hains, Corps of Engineers.

These defenses include three masonry works of old type.

No work was done on the two batteries for 3-inch rapid-fire guns. The guns and their mounts have not yet been furnished by the Ordnance Department.

Only minor repair work to the modern fortifications was carried on during the fiscal year.

Under the appropriation for "Supplies for Seacoast Defenses" supplies were furnished at a cost of $7.46.

(See Appendix 2 M.)

Defenses of east coast of Florida and of Key West, Fla.—Officers in charge, Capt. Thomas H. Rees, Corps of Engineers, until August 10, 1901; Lieut. Edmund M. Rhett, Corps of Engineers, from August 10, 1901, to September 11, 1901; and Capt. Herbert Deakyne, Corps of Engineers, since September 11, 1901; assistant, Lieut. Edmund M. Rhett, Corps of Engineers, until August 10, 1901; Division Engineer, Col. Peter C. Hains, Corps of Engineers.

The defenses include two masonry works of old type. One of them, Fort Marion, was built by the Spaniards in the eighteenth century and is of little value for defensive purposes. It is, however, an interesting historical relic and should be preserved. During the year the walls, doors, and windows of casemate No. IV were repaired.

The other work has been dismantled of its old armament and a portion of it has been torn down.

Near the mouth of the St. Johns River, where the temporary batteries were built during the war with Spain, the engineer property and torpedo material were cared for during the year with funds provided from the appropriation for "Preservation and Repair of Fortifications."

A deed from the United States marshal for 117.7 acres of land was received April 11, 1902. On June 5, 1902, an allotment of $50 was made, and the expenditure of the balance remaining from the allotment made for the acquisition of the land and for contingent expenses connected therewith was authorized for the purpose of marking the boundaries of the reservation acquired with stone monuments.

At Key West at the beginning of the fiscal year the condition of the defenses was as follows:

Emplacements for four 10-inch and for two 8-inch guns on disappearing carriages were completed far enough to be serviceable, and the guns were mounted.

Emplacements for two 4.7-inch rapid-fire guns were completed and the guns were mounted.

Emplacements for two 12-inch guns on nondisappearing carriages were completed and the guns were mounted.

Five emplacements for 3-inch rapid-fire guns were completed and the guns were mounted; one emplacement was in process of construction.

Emplacements for three 8-inch converted rifles were completed and the guns were mounted.

Emplacements for eight 12-inch mortars. Emplacements are incomplete; the mortars are mounted.

During the year one emplacement for 3-inch rapid-fire gun, in process of construction at the beginning of the year, was completed as far as possible prior to receipt of base casting.

A range-finder tower for battery commander's station was completed and turned over to the artillery.

A pumping plant was installed to keep water out of the pits at the mortar battery.

Two storehouses for 10-inch and 8-inch battery were constructed.

The work of completing gun and mortar batteries under the contract of December 24, 1900, was continued during the year. The work was not pushed energetically by the contractors and very little progress was made.

The submarine-mine material was transferred to the artillery October 15, 1901.

Minor repairs have been made under allotments from the appropriation for "Preservation and Repair of Fortifications."

Supplies for the artillery have been purchased, upon approved requisitions, with funds from the appropriation for "Supplies for Seacoast Defenses."

(See Appendix 2 N.)

Defenses of Tampa Bay, Florida.—Officers in charge, Capt. Thomas H. Rees, Corps of Engineers, until August 10, 1901; Lieut. Edmund M. Rhett, Corps of Engineers, from August 10, 1901, to September 11, 1901; and Capt. Herbert Deakyne, Corps of Engineers, since September 11, 1901; assistant, Lieut. Edmund M. Rhett, Corps of Engineers, until August 10, 1901; Division Engineer, Col. Peter C. Hains, Corps of Engineers.

At the beginning of the fiscal year the condition of the defenses was as follows:

Emplacements for two 8-inch guns on disappearing carriages were completed and the guns were mounted.

Emplacements for two 6-inch quick-firing guns were completed and the guns were mounted.

Emplacements for three 3-inch rapid-fire guns were completed except the platforms; the guns and mounts had not been received.

Emplacements for eight 12-inch mortars were completed; the carriages were mounted; the mortars had not been received.

Emplacements for two 3-inch rapid-fire guns. Preparatory work was done and active construction was about to begin.

During the year, at one locality, one emplacement for 3-inch rapid-fire gun was constructed. Platforms for three 3-inch rapid-fire guns in emplacements already built were laid as far as possible prior to arrival of base castings.

At another locality two emplacements for 3-inch rapid-fire guns, in process of construction at the beginning of the year, were completed.

At both localities miscellaneous minor work has been done under allotments from the appropriation for "Preservation and Repair of Fortifications," and supplies required by the garrisons have been purchased with funds allotted from the appropriation for "Supplies for Seacoast Defenses."

(See Appendix 2 O.)

Defenses of Pensacola, Fla.—Officers in charge, Capt. William V. Judson, Corps of Engineers, until November 4, 1901, and Lieut. Robert R. Raymond, Corps of Engineers, since that date; Division Engineers, Col. Peter C. Hains, Corps of Engineers, until July 24, 1901, and Lieut. Col. Henry M. Adams, Corps of Engineers, since that date.

The defenses include two works of old type.

At the beginning of the fiscal year emplacements were completed for four 10-inch guns, two 12-inch guns, and two 8-inch guns, all on disappearing carriages; eight 12-inch mortars; two 4.7-inch guns on naval mounts; and four 3-inch rapid-fire guns on balanced-pillar mounts. All the armament was mounted and the emplacements were in the hands of the artillery.

During the year minor repairs have been made to these works and several wet magazines have been entirely lined with an interior waterproof structure. A system of exterior wiring for electric lighting was installed.

Communicating galleries between the loading platforms at 8-inch and 10-inch batteries were constructed, a boathouse for naphtha launch was built, and a contract for furnishing steel doors for certain magazines was entered into.

An experimental system of range finding was partially installed, the work having progressed well at the end of the year.

From time to time supplies were furnished on approved requisitions of the acting engineer officer.

(See Appendix 2 P.)

Defenses of Mobile and of Mississippi Sound.—Officers in charge, Maj. William T. Rossell, Corps of Engineers, until September 9, 1901, and Capt. Spencer Cosby, Corps of Engineers, since that date; Division Engineers, Col. Peter C. Hains, Corps of Engineers, until July 24, 1901, and Lieut. Col. Henry M. Adams, Corps of Engineers, since that date.

The defenses consist of three masonry works of old type, two of which are in charge of ordnance sergeants, and of the following modern works at two sites:

A battery of two 12-inch rifles mounted on disappearing carriages.

A battery of eight 12-inch B. L. steel mortars.

A battery of four 8-inch B. L. steel rifles mounted on disappearing carriages.

A battery of two 4.7-inch Armstrong rapid-fire guns on pedestal mounts.

Two batteries of two 3-inch rapid-fire guns on balanced-pillar mounts.

A battery of two 8-inch B. L. rifles mounted on modified 15-inch Rodman carriages.

A battery of two 6-inch quick-fire guns mounted on disappearing carriages.

At the beginning of the fiscal year all batteries had been completed, except for a few minor details at the mortar battery, and at the 6-inch and 3-inch batteries. All batteries at both sites have been transferred to the artillery.

During the fiscal year the mortar battery was completed, except for the firing apparatus, which is partially installed. A part of the covering of the west flank and central traverse of this battery slid into the pit, breaking the concrete cornice in the immediate vicinity. This was caused by the slipping of the covering of sand and a 4-inch layer of concrete on the asphalt waterproofing. Repairs were made with funds allotted for the purpose.

The 6-inch battery was completed in all its details and the carriages were mounted.

The 3-inch battery was completed in all its details.

At the 8-inch battery interplatform galleries of steel were erected.

Three bases for Rafferty range finders were installed.

A peace storage magazine was begun, and its erection is now nearly completed.

The various defensive works were repaired and preserved as occasion required, with funds from the appropriation for "Preservation and Repair of Fortifications."

With funds which had been allotted from appropriation for "Sea Walls and Embankments," a riprap sea wall 235 feet long, including riprap ending, was constructed, and a portion of the old sea wall which had been damaged by storm was repaired.

Supplies for the artillery were purchased upon approved requisitions with funds from the appropriation for "Supplies for Seacoast Defenses."

(See Appendix 2 Q.)

Defenses of New Orleans, La., and of Sabine Pass, Tex.—Officers in charge, Lieut. Edward M. Adams, Corps of Engineers, in temporary charge until October 6, 1901, and Lieut. Col. Henry M. Adams, Corps of Engineers, since that date; assistants, Lieut. Edward M. Adams, Corps of Engineers, from October 6, 1901, to December 13, 1901, and Lieut. Paul S. Bond, Corps of Engineers, since March 19, 1902.

New Orleans, La.—The defenses of New Orleans include several masonry works of old type and the following modern emplacements:

One battery of two 10-inch B. L. rifles, disappearing carriages.

Two batteries of two 8-inch B. L. rifles each, disappearing carriages.

One battery of two 4.7-inch rapid-fire guns, pedestal mounts.

Two batteries of two 3-inch rapid-fire guns each, pillar mounts.

Emplacements for two additional 3-inch rapid-fire guns are completed, but guns not mounted.

During the past fiscal year two emplacements for 6-inch rapid-fire guns were commenced and concrete work completed. A site was acquired on July 7 for the location of two additional emplacements for 6-inch rapid-fire guns.

A range-finder tower for fire commander's station was commenced. The foundation was completed, and the erection of the ironwork of the tower is in progress. It is expected that the tower will be completed in August, 1902.

The two 10-inch B. L. rifles were dismounted, the carriages removed, and new carriages substituted, the base rings releveled, and guns again mounted.

Funds were allotted for the repair and raising of a levee. The levee was nearly completed when about 300 feet of it was destroyed by a storm in August, 1901. The break was repaired and a protection revetment constructed.

Repairs were made to the parts of the fortifications most urgently in need, including the loading platform of an 8-inch battery. The casemate of one dynamo plant was rendered dry.

Requisitions from the artillery for electrical supplies were filled, and a reflector for the searchlight purchased.

The torpedo material was overhauled, inspected, and cared for until transferred to the artillery on November 6, 1901.

Sabine Pass, Texas.—No work was done at this locality during the year. No funds were available.

(See Appendix 2 R.)

Defenses of Galveston, Tex.—Officer in charge, Capt. Charles S. Riché, Corps of Engineers; assistant, Lieut. Meriwether L. Walker, Corps of Engineers, until January 24, 1902; Division Engineers, Col. Amos Stickney, Corps of Engineers, until July 24, 1901, and Lieut. Col. Henry M. Adams, Corps of Engineers, since that date.

At the beginning of the fiscal year plans and estimates had been submitted for approval and material had been received for constructing field offices and repairing and constructing plant. Plans and estimates were received approved July 7, 1901, and active operations at once commenced.

A railway track on trestle had to be constructed from Ninth street and Avenue A, Galveston, Tex., to the sites of the various works at site No. 1. The work of building the railway trestle and track was commenced July 25, 1901, and entirely completed to all the sites of

the works on May 15, 1902. Nineteen thousand and twelve feet of track and trestle were constructed; also a side track 600 feet in length.

As the appropriation made by act of March 1, 1901, did not provide funds for the construction of this track and trestle, all works at site No. 1 have been charged with a pro rata share of expense of building this trestle and track.

The wharf and tracks for submarine-mining service, together with the submarine-mine warehouse and the cable-tank house, have been completed. Sheet piling around the two rapid-fire batteries and mining casemate has been completed and grouting has been filled in under the 4.7-inch rapid-fire battery and commenced under the 15-pounder rapid-fire battery. The riprap storm protection for both of these batteries has been begun. Some minor concreting has also been done.

All property of value has been removed from the wreck of the 10-inch gun battery, and the breaking up of its concrete for use as riprap protection for the new battery has been begun.

Mortars and carriages and other ordnance and engineer property are being removed from the wreck of the mortar battery preparatory to breaking it up for riprap by blasting.

Work at site No. 2 has progressed satisfactorily, and good progress in the repairing of the batteries has been made. Sheet piling has been completed around all the batteries at this reservation, grout has been filled in under them, and a little over half of their riprap storm protection is in place. Some minor concreting has also been done.

Work at site No. 3 has been delayed in the hope that the Gulf and Interstate Railway at Bolivar Point would rebuild and operate its road and a transfer system between Galveston and Bolivar Point. None of this work was done by this road during the fiscal year, and the possibility of anything being done in the near future now looks doubtful.

At the close of the fiscal year plans are being prepared for organizing the work at site No. 3 and rushing it through as quickly as possible.

Site No. 1.—Reconstruction of battery for two 10-inch guns on disappearing carriages: At the beginning of the fiscal year the old battery had been abandoned and all ordnance material removed from same.

During the fiscal year railway communication has been established to the site of the battery. It was completed May 14, 1902.

Work of breaking up old battery has been commenced and stairways, switchboards, etc., have been removed. Sixty-two I-beams were taken from concrete of battery.

Reconstruction of battery for eight 12-inch mortars: At the beginning of the fiscal year the old battery had been abandoned.

During the fiscal year railway communication has been established to the site of the battery. It was completed May 15, 1902.

The removal of ordnance property from the old battery has been commenced and all mortars have been removed to storage ground and blocked up, and parts of carriages have been taken apart ready to be removed.

Repair of battery for two 4.7-inch rapid-fire guns: At the beginning of the fiscal year sand had been placed under this battery to protect the piling from the action of the teredo, and a breakwater of small riprap had been placed around the battery to prevent the sand from being washed from under it by high tides. The concrete portion of the battery was standing on piling. The guns were mounted.

During the fiscal year railway communication has been established

to the site of the battery. It was completed April 16, 1902. Sheet piling around battery has been completed; also grouting under battery. Foundation for pavements in rear of east and west guns was completed, and concreting between sheet piling and foundation piling has been commenced. Placing of large and small riprap for revetment around the battery has been commenced.

Repair of battery for 3-inch rapid-fire guns: At the beginning of the fiscal year sand had been placed under this battery to protect the piling from the action of the teredo, and a breakwater of small riprap had been placed around the battery to prevent sand from being washed from under it by high tides. Concrete portion of battery was standing on piling.

During the fiscal year railway communication has been established to the site of the battery. It was completed April 7, 1902. Sheet piling around the battery has been completed. Grouting under the battery was commenced and placing of riprap for revetment around battery.

Reconstruction of mining casemate in traverse of 15-pounder battery: Nothing had been done on this work at beginning of the fiscal year.

During the fiscal year railway communication has been established to the site of the work. It was completed April 7, 1902.

Sand has been placed for foundation. Sheet piling and foundation piles for casemate and cable gallery have been driven.

Reconstruction of submarine-mine warehouse: Nothing had been done on this work at beginning of the fiscal year.

During the year railway communication has been established to the site of the warehouse. Same was completed February 18, 1902.

The warehouse has been reconstructed and all submarine-mine material stored in same.

Repair of cable tank: Nothing had been done on this work at the beginning of the fiscal year.

During the year railway communication has been established to the site of the tank. It was completed February 24, 1902. The building has been erected over the cable tank, cable cleaned, tank cleaned out, and ends of cables suspended out of water.

Reconstruction of tracks and wharf for submarine-mine service: Nothing had been done on this work at the beginning of the fiscal year.

During the year railway communication has been established to the site of the work. It was completed December 3, 1901. The tracks to the cable tank, to the gallery of the warehouse, and to the warehouse have been completed; also wharf, tram track, hand rails, and inclines.

Site No. 2.—Repair of battery for two 10-inch guns: No work had been done on this battery at the beginning of the fiscal year. The concrete portion of the battery was standing on piling. The guns were mounted.

During the fiscal year all sheet piling has been driven around battery. Grouting under the battery was completed. The riprap revetment was about half completed, and the space between sheet piling and foundation piling was filled with small riprap.

Repair of battery for eight 12-inch mortars: No work had been done on this battery at the beginning of the fiscal year. The concrete portion of the battery was standing on piling.

During the fiscal year all sheet piling has been driven around the

battery, and foundation piles for wing walls had been driven. Grouting under the battery was completed, and concrete between sheet piling and foundation piles on both ends, in front, and in the rear of the battery, except in rear of mortar pits, had been placed. New wing walls and west observation station were constructed. Riprap protection has been about six-tenths completed.

Repair of battery for 3-inch rapid-fire guns: No work had been done on this battery at the beginning of the fiscal year. The concrete portion of the battery was standing on piling.

During the fiscal year all sheet piling has been driven. Grout under the battery and concrete between sheet piling and foundation piles completed. Pavement in rear of the battery and riprap protection were completed. This battery is complete except sand protection and mounting of the guns.

Restoring railway approaches and fence around reservation: No work had been done at the beginning of the fiscal year. Railway approaches had been entirely destroyed by hurricane of September 8, 1900.

During the fiscal year the railway approaches have been restored.

Site No. 3.—Repair of battery for two 8-inch guns: No work had been done on this battery at the beginning of the present fiscal year, except that sand had been filled under the battery to protect the piling from the action of the teredo. The east gun platform was cracked off of this battery. Concrete portion of battery and west gun platform was standing on piling.

During the fiscal year sand washed from under battery by high tides and storms has been replaced from time to time.

Repair of battery for three 3-inch rapid-fire guns: No work had been done on this battery at the beginning of the present fiscal year, except that sand had been placed under the battery to protect the piling from the action of the teredo. This battery was standing on piling.

During the year sand washed from under battery by high tides and storms has been replaced from time to time.

Restoring railway approaches and fence around reservation: No work had been done at the beginning of the fiscal year. Railway approaches and fence, which were carried away by the hurricane of September 8, 1900, were completed.

During the year materials for the restoring of the railway approaches have been purchased.

(See Appendix 2 S.)

Defenses of lake ports.—Officers in charge of defenses of the Detroit River, Maj. Walter L. Fisk, Corps of Engineers, until November 7, 1901, and Capt. Lansing H. Beach, Corps of Engineers, since that date; Division Engineers, Col. Samuel M. Mansfield, Corps of Engineers, until July 24, 1901, and Lieut. Col. Oswald H. Ernst, Corps of Engineers, since that date. Officer in charge of defenses of Lake Champlain, Capt. Harry Taylor, Corps of Engineers; assistant, Lieut. Robert R. Raymond, Corps of Engineers, until November 2, 1901; Division Engineer, Col. Charles R. Suter, Corps of Engineers. Officer in charge of other lake ports in New York, Maj. Thomas W. Symons, Corps of Engineers; Division Engineers, Col. Charles R. Suter, Corps of Engineers, until July 24, 1901, and Col. Samuel M. Mansfield, Corps of Engineers, since that date.

These consist of four works of older type, two of which are garrisoned, one in the charge of an ordnance sergeant, and one in the charge of an ordnance sergeant with a fort keeper to care for the public property stored there.

Operations during the year consisted of repairs to three revetments inside one of the forts, and of repairs to fences and to the bridge leading across the moat at another fort.

(See Appendix 2 T.)

Defense of San Diego, Cal.—Officers in charge, Capt. James J. Meyler, Corps of Engineers, until December 12, 1901; Lieut. Col. Charles E. L. B. Davis, Corps of Engineers, from December 13, 1901, to January 28, 1902; Lieut. Col. Thomas H. Handbury, Corps of Engineers, from January 28, 1902, to March 31, 1902, and Capt. Edgar Jadwin, Corps of Engineers, since March 31, 1902; Division Engineers, Col. Jared A. Smith, Corps of Engineers, until September 23, 1901, and Lieut. Col. David P. Heap, Corps of Engineers, since September 23, 1901.

At the beginning of the fiscal year the modern fortification works consisted of—

Emplacements for four 10-inch B. L. guns on disappearing carriages, completed and armed.

Emplacements for two 3-inch rapid-fire guns on balanced-pillar mounts, completed except the gun platforms.

Emplacements for two 5-inch rapid-fire guns on balanced-pillar mounts, completed and gun carriages mounted.

Battery commander's station completed; depression position finder, type A, mounted.

Mining casemate, cable tank, and torpedo storehouse completed and torpedo material stored in same.

On November 9, 1900, an allotment was made for the construction of two emplacements for 3-inch rapid-fire guns, but the work of construction of this battery was delayed to enable the Department to acquire additional land. The additional land required has been purchased, and the construction of these emplacements was begun in September, 1901. They have been completed and were turned over to the artillery May 10, 1902.

At the 10-inch battery passages were cut through the traverses connecting Emplacements Nos. 1, 2, and 3 at the reference of the gun platforms.

Painting, whitewashing, and minor repairing were done as far as permitted by funds available.

(See Appendix 2 U.)

Defenses of San Francisco, Cal.—Officers in charge, Lieut. Col. Charles E. L. B. Davis, Corps of Engineers, until January 28, 1902, and Lieut. Col. Thomas H. Handbury, Corps of Engineers, since that date. Officer in charge of torpedo defenses, Lieut. Col. William H. Heuer, Corps of Engineers.

The old defenses included two masonry works and a number of earthen barbette batteries of old type at various points in the harbor, while 11 platforms for 8-inch converted rifles have been constructed.

At the close of the last fiscal year the modern defenses consisted of a pneumatic dynamite battery of three 15-inch guns; two batteries

with sixteen mortars mounted in each; one battery for sixteen mortars, in which four carriages were mounted and two additional base rings set; thirteen 12-inch gun emplacements with all guns mounted; two 12-inch gun emplacements, completed except setting base rings; five emplacements for 10-inch guns, completed and all guns mounted; eight emplacements for 8-inch guns, completed with guns mounted in seven; two emplacements for 6-inch guns, completed and the carriages mounted, guns not received; five emplacements for 5-inch rapid-fire guns on pillar mounts, carriages being mounted, guns not received; four emplacements for 5-inch Brown segmental wire-wound guns, completed except setting base rings, which had not been received. Work was commenced on two 3-inch emplacements; eight range-finder stations, type A, completed; two shelters and power houses for 30-inch searchlights, completed and searchlights installed.

During the year the work of construction was as follows:

Nine base rings were set and 11 carriages mounted in a mortar battery for sixteen mortars, leaving one base ring still to be set; work was commenced on a battery for eight mortars and work was well advanced; one base ring was set and one carriage mounted in a battery for two 12-inch guns, carriage for remaining emplacement not received; work was commenced and completed on one 12-inch gun emplacement, gun and carriage not received; work was commenced on two 12-inch gun emplacements and the battery was about two-thirds completed; a gun was mounted in an 8-inch emplacement; the excavation for four 6-inch gun emplacements was started; carriages were mounted in five emplacements for 5-inch guns on pillar mounts, the guns for which were not received; five emplacements for 3-inch guns were constructed except setting of pedestals which were not received, guns and carriages not received; the excavation for two 3-inch emplacements was commenced and practically completed; the azimuth circles (model 1891) of a mortar battery for sixteen mortars were changed for circles of mortar carriages, model 1896; funds were available for construction of battery commander's station, but no work was done owing to a possible change in location of site; several engineer buildings and a new steamer were constructed, and considerable repair work was done on electric plants about the batteries.

At the torpedo station the keeper, with such assistance as was necessary, kept the station in good order and made minor repairs during the year.

The roof of the torpedo shed, which was damaged by a windstorm, was repaired, and the windows of the shed, on the side nearest the naval training school, after having all the broken panes replaced, were covered with wire screens.

A small amount of obsolete torpedo material was shipped to the depot.

The buildings are in good condition.

This station has not yet been turned over to the artillery

(See Appendix 2 V.)

Defenses of mouth of Columbia River, Oregon and Washington.—Officer in charge, Capt. William C. Langfitt, Corps of Engineers; Division Engineers, Col. Jared A. Smith, Corps of Engineers, until September 23, 1901; Lieut. Col. David P. Heap, Corps of Engineers,

from September 23, 1901, to September 30, 1901, and Lieut. Col. William H. Heuer, Corps of Engineers, since September 30, 1901.

With the new works are included one work of the old type, with one serviceable 15-inch smoothbore gun and two serviceable 8-inch converted rifles mounted on front-pintle carriages.

At the beginning of the fiscal year there had been completed six emplacements for 10-inch rifles on disappearing carriages, three emplacements for 8-inch rifles on disappearing carriages (one experimental carriage), one mortar battery of eight 12-inch rifled mortars on spring-return carriages, four emplacements for 6-inch B. L. rifles on disappearing carriages, and four emplacements for 15-pounder rapid-fire guns on balanced-pillar mounts. There had also been constructed two electric-light stations, two mining casemates, one torpedo storehouse, two cable tanks, and a wooden platform for 15-inch smoothbore gun. All of the completed emplacements had been turned over to the artillery, and the condition of ordnance was as follows: Six 10-inch guns, mounted; eight 12-inch mortars, mounted; three 8-inch guns, mounted; four 6-inch carriages, mounted, guns not received; two 3-inch rapid-fire guns on balanced-pillar mounts, mounted.

During the fiscal year two additional 6-inch emplacements for rapid-fire guns on pedestal mounts have been completed and turned over to the artillery, and at the close of the fiscal year no construction work was in progress.

Under allotment from appropriation for "Supplies for Seacoast Defenses," the old and defective boiler of electric-light station at site No. 1 was replaced with a new one of better type and greater capacity. Estimates were also submitted for installation of searchlights; changing shot lifts of the different emplacements to those of adopted type; installation of telautographs; and laying of submarine cables to a point beyond low water.

For the ordnance of the completed emplacements of modern type there are six guns and two base castings of the 6-inch rapid-fire and four 3-inch guns and mounts to be mounted. None of these have yet been received.

(See Appendix 2 W.)

Defenses of Puget Sound, Washington.—Officer in charge, Maj. John Millis, Corps of Engineers; Division Engineers, Col. Jared A. Smith, Corps of Engineers, until September 23, 1901; Lieut. Col. David P. Heap, Corps of Engineers, from September 23, 1901, to September 30, 1901; and Lieut. Col. William H. Heuer, Corps of Engineers, since September 30, 1901.

At the close of the last fiscal year emplacements had been practically completed as follows: For four 12-inch guns on nondisappearing mounts; for nine 10-inch guns on nondisappearing mounts; for four 10-inch guns on disappearing mounts; for thirty-two 12-inch mortars; and for six 5-inch rapid-fire guns, balanced-pillar mounts. Emplacements for three 8-inch guns on disappearing mounts had been nearly finished. At all of the above emplacements the installation of the electrical service had not been undertaken, and more or less finishing work of minor importance remained to be done at each. A temporary storage basin for torpedo cable had been built and a torpedo storehouse practically completed, except heating and lighting plant.

The following emplacements had been commenced at the close of

last year: For three 10-inch guns on disappearing mounts; for eight 12-inch mortars; for two 5-inch guns, mounts not determined; for eight 3-inch rapid-fire guns, two on pedestal mounts and six on balanced-pillar mounts.

Work on all of the above was prosecuted during the year, excepting the battery for two 5-inch guns, mounts not determined. Work on this latter was suspended, pending decision of questions relative to type of gun and mount. Finishing and repair work at the various emplacements noted above as practically completed was also done.

The following emplacements were practically finished during the year except the installation of the electrical service: For eight 12-inch mortars, for three 8-inch guns on disappearing mounts, and for six 3-inch rapid-fire guns on balanced-pillar mounts.

Work on the emplacements for three 10-inch guns on disappearing mounts was greatly delayed by difficulties in obtaining steel beams. Concrete work had been carried to the level of the ceiling beams when work had to be suspended. Upon the receipt of these beams shortly before the close of the year, active operations were resumed.

Emplacements for two 3-inch rapid-fire guns were partly built; pavements are yet to be laid, and general finishing of walls and surfaces and painting of ironwork yet to be done.

Two fire commanders' and two battery commanders' stations, low-site type, were finished during the year. One fire commander's and two battery commanders' stations, high-site type, were in condition for service at the close of the year, but not finished on account of delay in receipt of metal work and glass for the roofs. Temporary shingled roofs were provided.

Revised plans and estimates for emplacements for two 6-inch rapid-fire guns were completed, but funds previously allotted for these were withdrawn.

One 12-inch gun and nondisappearing carriage, eight mortar carriages, and two mounts for 5-inch rapid-fire guns were mounted during the year. The mortar carriages were mounted by the artillery. Two 10-inch rifles, two disappearing carriages for same, and two disappearing carriages for 8-inch guns were received during the year.

General estimates for the electrical service at the most important forts were prepared, and a general study was made of emplacements yet to be built to complete the defenses of Puget Sound.

The following emplacements and stations were transferred to the artillery during the year: Emplacements for four 12-inch guns, nondisappearing mounts; for nine 10-inch guns, nondisappearing mounts; for four 10-inch guns, disappearing mounts; for thirty-two 12-inch mortars; for six 5-inch rapid-fire guns; two fire commanders' stations, high-site type; and two battery commanders' stations, high-site type. Emplacements for eight 12-inch mortars in addition to the above were ready for transfer on June 30, 1902, but the transfer was not effected.

The Admiralty Head light-house, which is being constructed by the War Department, under a special appropriation and an allotment from the general appropriation for defensive works as authorized June 9, 1900, was well under way at the close of the year. Most of the material was on hand, the foundation completed, and walls begun.

(See Appendix 2 X.)

Defenses of San Juan, P. R.—Officers in charge, Capt. Clement A. F. Flagler, Corps of Engineers, until May 12, 1902, and Capt. Francis R. Shunk, Corps of Engineers, since that date.

A semaphore tower at the Morro was converted into a practice station for range finder. Various minor repairs were made at the Morro and at San Cristobal.

(See Appendix 2 Y.)

ENGINEER EQUIPMENT OF TROOPS AND CIVILIAN ASSISTANTS TO ENGINEER OFFICERS.

By act of Congress approved March 2, 1901, the sum of $20,000 was appropriated for the equipment of engineer troops in the field, for the procurement of ponton trains, intrenching tools, instruments, drawing materials, etc., and the sum of $25,000 for civilian assistants to engineer officers serving on the staffs of division, corps, and department commanders to enable them to secure the employment of surveyors, draftsmen, photographers, master laborers, and clerks. Both appropriations were limited to the fiscal year 1902.

With the funds appropriated for the purposes above stated, engineering supplies were furnished mainly through the United States engineer depots for the various military departments in the United States, the Philippines, and Porto Rico, and the several engineer officers attached to important military commands and departments have been supplied with the necessary civilian assistants. Under the act $19,687.94 was allotted from the equipment appropriation and a balance of $312.06 reverted to the Treasury. From the appropriation for civilian assistants $11,567.55 was allotted and a balance of $13,432.45 reverted to the Treasury, because the year was well advanced before the general officers commanding the several departments in the United States could be provided with engineer officers and their civilian assistants.

The Army appropriation act of June 30, 1902, provided $25,000 for the engineer equipment of troops and $25,000 for civilian assistants to engineer officers for the fiscal year ending June 30, 1903. The sum of $25,000 each for engineer equipment of troops and for civilian assistants to engineer officers is estimated as required for the next fiscal year.

For details of expenditures under these appropriations see Appendixes Nos. 3, 4, and GGG.

ESTIMATES OF APPROPRIATIONS REQUIRED FOR 1903–1904.

Fortifications.

For gun and mortar batteries:		
For construction of gun and mortar batteries	$4,000,000	
For installation of range and position finders	325,000	
		$4,325,000
For sites for fortifications and seacoast defenses		2,000,000
For searchlights for harbor defenses		500,000
For protection, preservation, and repair of fortifications		300,000
For preparation of plans for fortifications		5,000
For supplies for seacoast defenses		35,000
For sea walls and embankments		160,000
For torpedoes for harbor defense		100,000
Total		7,425,000
For engineer equipment of troops		25,000
For civilian assistants to engineer officers		25,000

POST OF WASHINGTON BARRACKS, D. C.

The post was garrisoned by a battery of light artillery under the command of Capt. (now Major) Charles D. Parkhurst, Artillery Corps, until October 10, 1901. Since that date the post has been garrisoned by the Third Battalion of Engineers and the Engineer band, under the command of Maj. William M. Black, Corps of Engineers.

The reservation on which this post is located is at the southern extremity of the city of Washington, D. C., lying between the Washington channel of the Potomac River and the James Creek Canal.

A portion of the reservation is occupied by the Army General Hospital, which forms an entirely separate command. Another portion of the reservation is low and marshy.

Contracts have been made during the year for filling in the low lands subject to overflow and protecting them by a sea wall.

The post affords very unsatisfactory accommodations in quarters for the garrison and for the storage of engineering materials. Allotments were made by the Quartermaster's Department during the year to fit the post for occupation by the increased garrison until the post can be reconstructed and buildings rearranged under the appropriation recently made for this purpose.

The post is supplied with water from the city mains, and the lighting of the post is by means of gas.

The garrison of the post from October 10, 1901, consisted of three companies of the Third Battalion of Engineers, and since December 25, 1902, of the whole battalion.

The post of Fort Foote, Md., was placed under the charge of the post commander November 26, 1901, and is used by the Engineer battalion for engineering instruction and target practice.

ENGINEER SCHOOL OF APPLICATION, U. S. ARMY.

The engineer officer in command of the post of Washington Barracks, D. C., is the commandant of the school.

During the year the name of the school was changed from "United States Engineer School" to "Engineer School of Application, U. S. Army."

The academic staff of the school consisted of the commandant, three instructors (captains of engineers), and the secretary (the post adjutant).

The method of instruction was by lectures, by a course of reading, the student officers taking notes and submitting them to the instructors, and by preparation of theses and projects on subjects selected by the instructors.

A programme for the course of instruction for officers and another one for instruction of enlisted men were prepared and were approved by the Chief of Engineers, U. S. Army.

During the year there were three different departments of the school, each under an instructor, viz:

Department of civil engineering.
Department of military engineering.
Department of electrics.

Instruction in all the departments of the first and the second winter's classes was completed by the end of April, 1902.

May 1 instructions in photography, reconnaissance work, and astronomy were commenced under the instructors in civil and military engineering.

A part of the work of the school has been in training selected enlisted men of the engineer battalion in the various mechanical trades. A trade school was established and fitted out for the purpose.

The work of compiling a field manual adapted to the requirements of our military system was continued during the year, and a small edition of Chapter I, entitled "Topographical Reconnaissance," was printed, bound, and circulated from the Office of the Chief of Engineers. Work on the other chapters was continued.

Various intrenching tools have been subject to trial and reports were rendered on this subject from time to time.

THE THIRD BATTALION OF ENGINEERS.

During the year Companies I, K, L, and M, forming the Third Battalion of Engineers, were organized.

Recruiting for the battalion before its departure from Willetts Point, N. Y., was carried on throughout the country. By the end of August, 1901, the average strength per company was 75 men, which was increased to 95 during September.

During August and September the regular guard and police duties were carried on, and the companies were instructed in infantry drills, pontoniering, in spar and trestle bridges, and selected enlisted men received instruction in the various mechanical trades and in operating land and marine engines.

The engineer troops of the Third Battalion on duty at Fort Totten, Willetts Point, N. Y., were relieved from duty at that station by General Orders, 117, Headquarters of the Army, Adjutant-General's Office, September 3, 1901, and were ordered to proceed to and take station at Washington Barracks, D. C.

The necessary labor incidental to the removal of the garrison and school was continued until its completion on October 7, 1901, when the troops embarked, in the evening, on the steamship *Guyandotte*, of the Old Dominion steamship line. The troops arrived at Washington Barracks, D. C., October 10, the freight was unloaded by contract, and the distribution of it was done by the troops.

During the winter months the companies were taken on practice marches, in heavy marching order, and were instructed in details of engineer work and in military gymnastics and signaling.

The company commanders gave instruction daily to the noncommissioned officers and selected privates in drill regulations, manual of guard duty, etc., and, as stated earlier, trade-school instruction was carried on.

During the year the battalion has taken part in various ceremonies, viz, funerals of President McKinley, General Ludlow, and Lord Pauncefote; the unveiling of various monuments, and other occasions.

In addition to the regular course of instruction, all materials were packed at Willets Point, N. Y., and unpacked at Washington Barracks; school property stored and cared for; instruction rooms fitted out; and the general work of the engineer depot carried on.

ENGINEER DEPOT, WASHINGTON BARRACKS.

The general property of the engineer depot and the engineer school has been cared for.

On the removal of the engineer school and the Third Battalion of Engineers to Washington Barracks, the property of the school, excepting the portion formerly used for instruction in submarine mining, and a limited quantity of tools and material were brought to the new post, the bulk of the depot property being left at Willets Point, N. Y.

A small naphtha launch was added to the school outfit during the year by transfer, but was out of repair and could not be used.

During the year arrangements have been completed for fitting instruction rooms and shops and laboratories for the photographic outfit, the printing outfit, library, depot, and school offices. The museum property is temporarily stored in an unoccupied stable building, until proper room for its reception can be provided.

One hundred and sixteen volumes of various professional periodicals were bound, and 64 professional books on scientific subjects were added to the library by purchase.

Purchases, with the limited funds available for depot and school use, have been made from time to time of materials and instruments needed to carry on the work of the depot and instruction in the school.

February, 1902, information was received of the intended transfer of the depot from Willets Point, and about fifty shipments of depot property were received from time to time up to the close of the fiscal year, amounting to over 1,000,000 pounds. All this property needs more or less cleaning, overhauling, and repairing.

No storage room was found at this post, and the depot property was stored in the gun shed, stables, magazines, and basement of one of the barracks. All has been properly cared for as far as practicable under the existing facilities.

Shipments from other sources were received at the depot under Circular No. 13, Office of the Chief of Engineers, June 7, 1902.

Issues of instruments which were available for issue from this depot have been made from time to time.

The four companies of the Third Battalion were supplied before leaving Willets Point, N. Y., with a complete outfit of field engineering instruments, materials, and tools.

Under an allotment of $2,000, appropriation for "Equipment of Engineer Troops," various purchases were made of experimental instruments and tools, of instruments to fill requisitions, and some new ponton material.

Twelve new pattern hand plane tables, of a design devised at this school, were bought for trial in this country and in the Philippines.

A number of small-sized shovels and pick-mattocks, of a special design, developed at this school, were bought and distributed for trial and test, with a view to their adoption for field service of our Army.

Torpedo-board records and torpedo-board property were transferred to the Artillery Corps.

STATEMENT OF FUNDS.

I. For Engineer Depot at Willets Point, N. Y., for fiscal year ending June 30, 1901, for "Washington Barracks:"	
October 8, 1901, amount received by transfer	$138.34
June 30, 1902, amount expended during fiscal year	138.34

II. For Engineer Depot at Willets Point, N. Y., for fiscal year ending June 30, 1902, for "Washington Barracks:"		
October 8, 1901, amount received by transfer		$3,708.44
June 30, 1902, expended to end of fiscal year	$3,425.00	
June 30, 1902, amount pledged	279.78	
June 30, 1902, to be turned into the Treasury	3.66	
		3,708.44
III. Torpedoes for Harbor Defense:		
October 8, 1901, amount received by transfer		6,300.00
June 30, 1902, withdrawn during fiscal year		6,300.00
IV. Equipment of Engineer Troops, 1902:		
For "Instruments, Intrenching Tools," etc.:		
November 29, 1901, amount allotted		2,000.00
June 30, 1902, amount expended and pledged during fiscal year	$1,999.00	
July 1, 1902, balance available to be turned into the Treasury	1.00	
		2,000.00
V. Gun and Mortar Batteries:		
Act May 25, 1900, for "Office Safes for Engineer School, Washington Barracks"—		
December 26, 1901, amount allotted		300.00
June 30, 1902, amount expended during fiscal year	$282.50	
June 30, 1902, amount turned into the Treasury during fiscal year	17.50	
		300.00
VI. Emergency fund, War Department:		
Act March 3, 1899, for "Equipment of Electrical Laboratory at Engineer School, Washington Barracks"—		
March 5, 1902, amount allotted		6,300.00
June 30, 1902, amount expended to end of fiscal year		349.09
July 1, 1902, balance available		5,950.91

(See Appendix No. 3.)

ENGINEER DEPOT, WILLETS POINT, N. Y.

The depot has been under the command of Maj. William M. Black, Corps of Engineers, to October 8, 1901; Capt. Charles H. McKinstry, Corps of Engineers, October 8 to November 6, 1901; and First Lieut. Edward H. Schulz, Corps of Engineers, from November 6, 1901, to end of fiscal year. The office of the depot was moved to Army Building, New York, on April 10, 1902. The depot was discontinued at Fort Totten, Willets Point, on June 30, 1902, and transferred to New York City.

During the past year, and since October 1, 1901, the work of transferring all property from the depot to other localities was in progress. Obsolete and unserviceable material was inspected and condemned. On account of the removal of the engineer troops and the Engineer School to Washington Barracks, all buildings heretofore used by the school have been transferred to the artillery. Also all depot buildings have been turned over to the artillery as they became vacated. The work of the depot was performed by enlisted men prior to the departure of the engineer troops, October 8, 1901, and since that time by hired civilians. Sergt. Charles M. Beer, Company C, First Battalion of Engineers, has been on extra duty in charge during the entire year.

The torpedo material on hand at the depot has all been transferred to the artillery. Issues were also made during the year to various

harbors. A portable searchlight on four trucks was sent to Fort Leavenworth, Kans.

The astronomical and meteorological instruments, etc., were shipped to various officers, as authorized by the Chief of Engineers, the bulk of this material, however, going to the depot at Washington Barracks.

The material pertaining to the equipment of engineer troops, intrenching tools, etc., was sent to the Philippine Islands, Fort Leavenworth, and Washington Barracks.

The ponton equipage was shipped to West Point, Fort Leavenworth, and Washington Barracks.

The charge of the construction of the addition to library and museum building at Willets Point was transferred on January 6, 1902, to Maj. William L. Marshall, Corps of Engineers.

The shipments from the depot during the year amounted to the following:

To—	Value.	Weight.
		Pounds.
Philippine Islands	$13,898.50	18,387
Washington Barracks, D. C.	59,753.41	402,956
Fort Leavenworth, Kans	110,943.59	797,754
West Point, N. Y.	6,850.97	30,074
Cuba	360.00	167
Alaska	100.00	351
Other parts of United States	20,259.26	185,892
Artillery (Wflets Point)	582,250.22	a 1,775,000
Third Battalion of Engineers (Willets Point)	2,730.19	a 3,000
	797,146.14	3,213,581

a Estimated.

Money statement.

I. Engineer Depot at Willets Point, N. Y., for fiscal year ending June 30, 1901:		
July 1, 1901, balance unexpended		$14.41
July 31, 1901, turned into Treasury		14.41
II. Engineer Depot at Willets Point, N. Y.:		
1. Act March 2, 1901, for "Incidentals," 1902—		
March 8, 1901, amount allotted		5,000.00
April 19, 1902, received by cash account of overcharge on voucher		1.05
		5,001.05
October 8, 1901, taken to Washington Barracks by Maj. William M. Black		1,800.00
June 30, 1902, amount expended during fiscal year		3,201.05
2. Act March 2, 1901, for "Materials," 1902—		
March 8, 1901, amount allotted		1,500.00
October 7, 1901, taken to Washington Barracks by Maj. William M. Black	$1,000.00	
June 30, 1902, amount expended during fiscal year	48.54	
October 7, 1901, deposited to credit Treasurer United States	451.46	
		1,500.00
3. Act March 2, 1901, for "Instruments," 1902—		
March 8, 1901, amount allotted		3,000.00
June 30, 1902, amount expended during fiscal year		3,000.00

II. Engineer Depot at Willets Point, N. Y.—Continued.		
4. Act March 2, 1901, for "Addition to Building for Models and Library"—		
March 8, 1901, amount appropriated		$12,000.00
January 6, 1902, amount transferred to Maj. W. L. Marshall		11,750.00
June 30, 1902, amount expended during fiscal year		250.00
5. Act March 2, 1901, for "Library," 1902—		
March 8, 1901, amount allotted		500.00
October 7, 1901, amount deposited to credit of Treasurer United States	$156.98	
June 30, 1902, amount expended during fiscal year	43.02	
October 7, 1901, amount taken to Washington Barracks by Maj. William M. Black	300.00	
		500.000
III. Equipment of Engineer Troops, 1901:		
1. For "Instruments, Intrenching Tools, etc."—		
July 1, 1901, balance unexpended		.83
July 31, 1901, turned into the Treasury		.83
2. For "Completing Ponton Trains"—		
July 1, 1901, balance unexpended		6.46
July 31, 1901, turned into the Treasury		6.46
Fiscal year 1902:		
3. For "Instruments, Intrenching Tools, etc."—		
June 30, 1902, total of allotments received during fiscal year		11,950.00
June 30, 1902, amount expended during fiscal year		11,950.00
4. For "Completing Ponton Trains"—		
June 30, 1902, total of allotments received during fiscal year		7,750.00
June 30, 1902, withdrawn during fiscal year		1,750.00
June 30, 1902, amount expended during fiscal year		6,000.00
IV. Torpedoes for Harbor Defense.		
1. Act March 3, 1899, for "Torpedo Experiments"—		
July 1, 1901, balance unexpended		1,893.72
October 1, 1901, amount taken to Washington Barracks by Maj. William M. Black	$1,000.00	
June 30, 1902, amount expended during fiscal year	893.72	
		1,893.72
2. Act May 25, 1900, for "Purchase of Submarine Mining Materials," etc.—		
July 1, 1901, balance unexpended		3,147.03
June 30, 1902, amount expended during fiscal year		3,147.03
3. Act March 1, 1901, for "Purchase of Submarine Mining Materials," etc.—		
July 1, 1901, balance unexpended		16,300.00
June 30, 1902, amount withdrawn during fiscal year		5,800.00
		10,500.00
October 7, 1901, amount taken to Washington Barracks by Maj. William M. Black	$5,300.00	
June 30, 1902, amount expended during fiscal year	3,124.61	
July 1, 1902, outstanding liabilities	420.48	
		8,845.09
July 1, 1902, balance available		1,654.91

(See Appendix No. 4.)

ESTIMATES OF APPROPRIATIONS REQUIRED FOR THE ENGINEER DEPOTS FOR 1903–1904.

For incidental expenses of the depots, including fuel, lights, chemicals, stationery, hardware, machinery, pay of civilian clerks, mechanics, and laborers, extra-duty pay to soldiers necessarily employed for periods not less than ten days as artificers on work in addition to and not strictly in the line of their military duties, such as carpenters, blacksmiths, draftsmen, printers, lithographers, photographers, engine drivers, telegraph operators, teamsters, wheelwrights, masons, machinists, painters, overseers, laborers; repairs of, and materials to repair, public buildings and machinery, and unforeseen expenses	$11,500.00
For purchase and repair of instruments, to be issued to officers of the Corps of Engineers and to officers detailed and on duty as acting engineer officers, for use on public works and surveys	5,000.00
Total	16,500.00

SERVICE OF OFFICERS OF THE CORPS OF ENGINEERS ABROAD AND IN THE FIELD, WITH TROOPS, JULY 1, 1901, TO JUNE 30, 1902.

LIEUT. COL. WILLIAM R. LIVERMORE.

July 1, 1901, to May 5, 1902.—Military attaché to the United States legations at Copenhagen, Denmark, and Stockholm, Sweden; stationed at Copenhagen, Denmark, since April 28, 1899, collecting information and reporting upon military subjects, consulting with the other military attachés and visiting factories of ordnance and armor in Norway, Russia, Germany, England, France, and Italy.

Left Copenhagen, Denmark, May 5, 1902; arrived at Washington, D. C., June 2, 1902, and reported to the Adjutant-General, United States Army, for duty.

LIEUT. COL. CHARLES E. L. B. DAVIS.

February 8, 1902.—Sailed from San Francisco, Cal., on the transport *Grant.*

March 10, 1902.—Arrived at Manila, P. I.

March 12, 1902.—Assigned to duty as engineer officer, Division of the Philippines, and as member of Board of officers to consider and report upon the subject of the defense of the important harbors of the Philippine Islands, relieving Major Sears of these duties.

MAJ. CLINTON B. SEARS.

July 1, 1901.—Engineer officer, Division of the Philippines, with supervision over the construction and repair of military roads and bridges in the Philippine Islands. Commanding the First Battalion of Engineers. Member of Board of officers for the examination of lieutenants of the Army for transfer to the Corps of Engineers.

July 12, 1901.—Relieved Captain Craighill of the improvement of the port of Manila and of the Pasig River from its mouth to the Laguna de Bay.

July 17, 1901.—Second Battalion of Engineers placed under his orders, as engineer officer.

July 31, 1901.—Member of committee appointed by the civil governor of the Philippine Islands to formulate legislation for the organ-

ization of a light-house establishment for the Philippine Islands. Report submitted September 24, 1901.

September 27, 1901.—Member of Board of officers to consider and report upon the subject of the defense of the important harbors of the Philippine Islands.

October 1, 1901.—Turned over the command of the First Battalion of Engineers to Captain Zinn.

October 26 to December, 1901.—Member of committee appointed by the Philippine Commission to locate and arrange for shops, etc., for the purchasing agent of the insular government.

December 23, 1901.—Assigned to the command of the Second Battalion of Engineers.

February 1, 1902.—Assumed command of the Second Battalion of Engineers.

March 12, 1902.—Relieved by Lieutenant-Colonel Davis as engineer officer, Division of the Philippines, and as member of Board of officers to consider and report upon the subject of the defense of the important harbors of the Philippine Islands.

March 20, 1902.—Detailed as disbursing officer for the office of the engineer officer, Division of the Philippines.

MAJ. HARRY F. HODGES.

July 2, 1901, to May 20, 1902.—Engineer officer, Department of Cuba. Charged with the supervision of the work of the engineer department, city of Habana; with the preparation of a map of the island of Cuba; with harbor works of the port of Habana, and with surveys near the city of Habana.

Commended by Brig. Gen. Leonard Wood for services as engineer officer, Department of Cuba, in letter to the Adjutant-General, United States Army, July 22, 1902.

CAPT. GEORGE A. ZINN.

July 1, 1901.—Engineer officer on the staff of the commanding general, Department of Northern Luzon. Commanding Company B, First Battalion of Engineers. Member of Board of officers for the examination of lieutenants of the Army for transfer to the Corps of Engineers.

September 10, 1901.—Member of Board of officers for the examination of certain ex-officers of the Volunteer Army for appointment as second lieutenants in the Regular Army.

September 30, 1901.—Relieved from duty as engineer officer, Department of Northern Luzon.

October 1, 1901.—Relieved Major Sears of the command of the First Battalion of Engineers.

October 18, 1901.—Sailed from Manila on the transport *McClellan* for New York City in command of Companies B, C, and D, First Battalion of Engineers.

December 23, 1901.—Arrived at New York City.

December 24–26, 1901.—En route from New York City to Jefferson Barracks, Mo., in command of Companies B and D, First Battalion of Engineers.

CAPT. WILLIAM E. CRAIGHILL.

July 1, 1901.—In supervisory control of the improvement of Manila Harbor. Member of Board of officers for the examination of lieutenants of the Army for transfer to the Corps of Engineers.

July 3, 1901.—Assigned to command of Company A, First Battalion of Engineers.

July 10, 1901.—Relieved from duty in the Division of the Philippines.

July 20, 1901.—Sailed from Manila on the transport *Sheridan* in command of Company A, First Battalion of Engineers.

August 18, 1901.—Arrived at San Francisco, Cal.

August 23-29, 1901.—En route from San Francisco, Cal., to Fort Totten, N. Y.

August 31, 1901.—Relieved from duty at Fort Totten and from command of Company A, First Battalion of Engineers.

CAPT. HENRY JERVEY.

June 15 to July 16, 1901.—On board transport *Hancock*, en route from San Francisco, Cal., to Manila, in command of the Second Battalion of Engineers.

July 20 1901.—Relieved Captain Craighill as member of Board of officers for the examination of lieutenants of the Army for transfer to the Corps of Engineers.

July 26, 1901.—Relieved from duty with the Second Battalion of Engineers and assigned to duty as assistant to the engineer officer, Division of the Philippines. In immediate charge of the improvement of the port of Manila.

September 23, 1901.—Charged with examination and report of water supply for convalescent hospital, Corregidor Island.

September 27, 1901.—Member of Board of officers to consider and report upon the subject of the defense of the important harbors of the Philippine Islands.

January 22, 1902.—Member of committee to make inventory of Government property in the province of Cavite, P. I.

March 20, 1902.—Detailed for duty as light-house engineer.

CAPT. CLEMENT A. F. FLAGLER.

July 1, 1901, to May 8, 1902.—Engineer officer, Department of the East, with station at San Juan, P. R. Assistant to engineer, Third Light-house District. In charge of preservation and repair of seacoast defenses at San Juan, P. R. Charged with the disbursement of funds allotted from the appropriation "Refunding Customs Revenue Collected from Puerto Rico, for the Relief of its Government and People," for relieving conditions of distress among the people in certain districts of the island.

CAPT. WILLIAM W. HARTS.

June 25 to July 16, 1901.—On board transport *Hancock*, en route from San Francisco, Cal., to Manila, P. I., with Second Battalion of Engineers and in command of Company H.

July 24 to November 29, 1901.—Engineer officer, Department of Southern Luzon, relieving Lieutenant Cheney.

July 25, 1901.—Relieved Captain Jervey of the command of the Second Battalion of Engineers.

August 23, 1901.—In command of the engineer garrison, post of Manila.

November 30, 1901.—Engineer officer, Department of North Philippines.

February 1, 1902.—Relieved by Major Sears of the command of the Second Battalion of Engineers.

March 24, 1902.—Member of Board of officers to determine the project for establishment of a military post near Manila. In charge of preliminary work of construction.

CAPT. ROBERT M'GREGOR.

June 25 to July 16, 1901.—On board transport *Hancock*, en route from San Francisco, Cal., to Manila, P. I., in command of Company F, Second Battalion of Engineers.

July 16 to August 31, 1901.—The company was in garrison at Cuartel de Malate, Manila, P. I., making repairs to barracks and reconnaissance sketches of the district of Ermita Paco and Malate. On August 31 the company left Manila for Iloilo, arriving September 2.

July 26 to August 23, 1901.—On detached service with the expedition of the Thirtieth United States Infantry to the island of Mindoro.

September 2 to December 30, 1901.—On duty with company at San Augustin Barracks, Iloilo, island of Panay.

September 3 to November 30, 1901.—Engineer officer, Department of the Visayas.

November 29, 1901.—Detailed as engineer officer, Department of South Philippines. Changed station to Cebu, island of Cebu, December 31, 1901.

December 2, 1901.—Charged with preliminary examination of Cebu Harbor, island of Cebu; duty completed March, 1902.

February 3, 1902.—Charged with survey and plans for permanent improvement of Iloilo Harbor, island of Panay.

February 21, 1902.—Directed to examine and report upon a project for the erection of a pier at Calbayog, Samar.

May 18, 1902.—Detached as sanitary engineer for the Civil Commission, and as city engineer of Manila.

May 26, 1902.—Detailed as engineer for the city of Manila.

CAPT. JAY J. MORROW.

June 25 to July 16, 1901.—On board transport *Hancock*, en route from San Francisco, Cal., to Manila, P. I., in command of Company G, Second Battalion of Engineers.

July 17 to August 31, 1901.—At Cuartel de Malate, Manila, in command of Company G.

August 31 to September 4, 1901.—En route to Zamboanga, Mindanao.

September 4 to November 30, 1901.—Engineer officer, Department of Mindanao and Jolo.

November 30, 1901.—Engineer officer, Seventh Separate Brigade.

February 20, 1902.—Commanding Post of Zamboanga.

May 14, 1902.—Detached for duty in connection with construction of roads near Malabang, Mindanao.

May 19, 1902.—Announced as engineer officer of the Lake Lanao expedition and in charge of the road work.

CAPT. JAMES B. CAVANAUGH.

July 1 to September 27, 1901.—On duty at Dagupan, Pangasinan, Philippine Islands, in charge of road work in that vicinity.

During this period practically all work for which funds were available was completed.

Salasa-Sual road: All work necessary to make it passable was completed by the middle of July and balance of funds made available for work on the Camiling-Bayambang road.

Camiling-Bayambang road: The ferry at Camiling was completed and installed, and three bad washouts, caused by storms and high water in the Camiling River during August, were repaired with unexpended balance of funds from Salasa-Sual road.

Dagupan-San Quintin road: About 2½ miles were covered with metal, completing all repairs necessary to make the road passable from Dagupan to Asingan and from Tayug to San Quintin. A small balance of funds and supply of material were reserved for maintenance and for minor repairs which might subsequently be needed.

A substantial barge ferry was constructed and installed for crossing the Cayanga River at San Fabian, Province of Pangasinan, and similar ferries were constructed and installed for crossing the Agno River at Salasa, and the Calmay River at Dagupan, P. I. Work was commenced upon construction of the Calmay Bridge at Dagupan. A steam pile driver was erected upon a scow built for the purpose, and about one-third of the piles were driven.

September 24, 1901.—Relieved of the above duties by Lieut. George R. Spalding, Corps of Engineers.

September 27, 1901.—Left for Manila, with Company D, First Battalion of Engineers, to take station at Cuartel de Malate, Manila, to await transportation to the United States.

October 17, 1901.—Embarked on the transport *McClellan*, with the First Battalion of Engineers, and in command of Company D.

October 18, 1901.—Sailed from Manila, Philippine Islands, via the Suez Canal, en route to the United States.

December 23, 1901.—Arrived in New York Harbor.

December 26, 1901.—Arrived at Jefferson Barracks, Mo., in command of Company D, First Battalion of Engineers.

LIEUT. WILLIAM J. BARDEN.

July 1, 1901, to May 20, 1902.—Chief engineer of the city of Habana; charged with the maintenance and repair of streets and roads; survey for establishment of street grades; street cleaning; collection and disposal of refuse; care and preservation of parks; maintenance and improvement of water supply; maintenance and repair of old sewerage system and preparation of plans for new sewerage system; collection and disposal of night soil; construction of an extension to sea wall along Gulf of Mexico; preparation of plans, renovation and repair and construction of municipal and State buildings.

Commended by Brig. Gen. Leonard Wood, for work as chief engineer of the city of Habana, in letter to the Adjutant-General, United States Army, July 22, 1902.

LIEUT. HARRY BURGESS.

July 1, 1901.—Stationed at Manila, P. I.; adjutant, recruiting office and acting quartermaster and commissary, First Battalion of Engineer In temporary command of Company D, First Battalion of Engineer until July 30, 1901.

September 20, 1901.—In temporary command of Company C, Fir Battalion of Engineers.

September 28, 1901.—Relieved from duty as acting quartermast and commissary, First Battalion of Engineers.

October 18, 1901.—Sailed from Manila, P. I., on transport *McClellan*, via the Suez Canal, en route to the United States. Adjutant ar recruiting officer, First Battalion of Engineers, in temporary commar of Company C, First Battalion of Engineers; adjutant of troops board of transport *McClellan*.

December 23, 1901.—Arrived in New York City.

December 24, 1901.—Conducted Company C, First Battalion Engineers, from New York City to West Point, N. Y.

December 24–25, 1901.—Conducted Company M, Third Battalion Engineers, from West Point, N. Y., to Washington Barracks, D.

January 10, 1902.—Joined post of Jefferson Barracks, Mo., as adjutant, First Battalion of Engineers.

January 31, 1902.—Changed station to Fort Leavenworth, Kans.

LIEUT. SHERWOOD A. CHENEY.

July 1–24, 1901.—Engineer officer, Department of Southern Luzo

July 1, 1901, to June 30, 1902.—Quartermaster and commissar First Battalion of Engineers.

July 1, 1901.—On duty with Company B, First Battalion of Engineers. In command of company until October 1, 1901.

October 18, 1901.—Sailed from Manila, P. I., on transport *McClella* via the Suez Canal, en route to the United States. Quartermaster ar commissary, First Battalion of Engineers. Prepared the battalic baggage for embarkation.

December 23, 1901.—Arrived at New York City.

December 26, 1901.—Arrived at Jefferson Barracks, Mo.

As engineer officer, Department of Southern Luzon, in gener charge of work of building and repairing certain roads and bridges the Department of Southern Luzon, Philippine Islands. Work w carried on on the following roads at the points mentioned:

Calamba-Tanauan road, at Calamba, Santa Tomas, and Tanaua under Second Lieut. W. G. Caples, Corps of Engineers, with detac ment of about 20 men from Company B, First Battalion of Engineer

Lipa-San Jose road, at Lipa and San Jose, under Mr. W. G. Kip late captain, Eleventh Cavalry, United States Volunteers, with detachment of 6 men from Company B, First Battalion of Engineer

Batangas-San Jose road, at Batangas, under Mr. W. H. Raymon late first lieutenant, Twenty-seventh Infantry, United States Volu teers, with 2 civilian foremen.

Taal-Spanish Fort road, under First Lieut. M. E. Eltinge, Sixth Cavalry, quartermaster at Taal.

Work at the above points paid for from allotment for repair of road from Calamba to Balayan, in Laguna and Batangas provinces.

Road from Nueva Caceres-Iriga, Camarines Sur, under First Lieut. William Kelly, Corps of Engineers, with a detachment of 20 men from Company B, First Battalion of Engineers, in the vicinity of Pila and San Jose, under allotment for repair of the Nueva Caceres-Iriga road.

Bridges between Silang and Indan, Cavite Province, under the direction of Capt. George B. Duncan, Fourth Infantry, commanding officer at Indan. Work done by First-class Private George Wells, Company B, First Battalion of Engineers. Funds from special allotment for repair of bridges, Silang-Indan.

All of the above allotments were made from the appropriation of public civil funds for the repair of roads and bridges, Philippine Islands (Act 1, Philippine Commission). Maps and sketches of scouts and marches were copied and compiled in the office.

As commanding officer, Company B, First Battalion of Engineers; the company headquarters were at the Cuartel de Malate, Manila, P. I., from 20 to 30 men being present. The remainder of the company was employed on road work throughout the department, as above indicated. The work of First-class Private George Wells on the bridges between Silang and Indan was specially commended by the commanding officer at the latter place, Capt. George B. Duncan, Fourth Infantry.

As quartermaster and commissary, First Battalion of Engineers; no duties, except so far as Company B was concerned, were performed. All supplies of engineer and quartermaster property, including tools, blasting supplies, animals, wagons, harness, spare parts, medicines, blacksmith supplies, etc., were forwarded to the detachments in the field; the depot being in charge of Q. M. Sergt. Peter W. Way, Company B, First Battalion of Engineers.

The work on which Company B, First Battalion of Engineers, was engaged and the circumstances under which the work had to be carried on were such as to call for great energy and patience on the part of the officers and men. In all cases it was faithfully and earnestly performed. To the noncommissioned officers and privates, many of whom were in charge of work not immediately under the observation of their superiors, especial credit is due for the good judgment and devotion to duty uniformly displayed. The following-named are especially mentioned:

First Sergt. Henry Loinson, for the able and efficient performance of his duties as first sergeant and his general management of the affairs of the company, especially in the absence of the company commander.

Q. M. Sergt. Peter W. Way, for faithful and intelligent management of the company depot of supplies.

Sergt. Alexander Neid, for faithful and efficient work on roads in the vicinity of Imus, Cavite Province.

Sergt. John Casey, for faithful and intelligent work on roads in the vicinity of Santo Tomas, Batangas Province.

Sergt. Henry C. Beck, especially commended by Lieut. William Kelly, Corps of Engineers, for work with his detachment in Camarines Sur.

Sergt. John Law, for faithful and intelligent work on bridges and ferries.

Sergt. Albert N. Woodruff, for faithful and intelligent work on the roads in the vicinity of Calamba, Laguna Province.

Sergt. John McVey (now in Company D, First Battalion of Engineers), commended by Lieut. William Kelly, Corps of Engineers, for excellent work on roads in Camarines Sur.

Corpl. William Ballman, for faithful and efficient work on roads and bridges in the vicinity of Calamba, Laguna Province.

First-class Private George Wells, for work on bridges between Silang and Indan.

LIEUT. HARLEY B. FERGUSON.

July 1 to September 10, 1901.—Stationed at Manila, P. I., attached to Company B, First Battalion of Engineers, on special duty under the direction of the engineer officer, Division of the Philippines.

July 1 to August 17, 1901.—Completing maps and drawings pertaining to the China relief expedition and preparing report on the foreign engineers in North China.

August 22 to September 10, 1901.—Preparing maps and collecting information preparatory to carrying out order to investigate the amount, quality, and accessibility of the coal deposits in the Philippines.

September 11, 1901.—Sailed from Manila, P. I., on transport *Buford*, via the Suez Canal, en route to the United States. Engaged during part of the voyage in writing report on transportation and equipment for engineer troops.

December 1, 1901.—Arrived at New York City.

LIEUT. LYTLE BROWN.

July 1 to August 7, 1901.—City engineer of Manila, P. I.; in charge of the department of public works and water supply of Manila.

August 7, 1901, to March 1, 1902.—In charge of the construction of the Santa Cruz Bridge. This is a highway bridge across the Pasig River and was completed at a cost of about $150,000. The work on the piers and abutments of the bridge was completed in August and the superstructure in November, 1901.

August 7 to September 1, 1901.—In charge of preliminary survey of new post of Manila. Under the direction of the engineer officer of the division, prepared a complete set of plans and estimates for proposed barracks, quarters, etc., for the proposed post of Manila. Lieutenants Peek and Dent were associated with Lieutenant Brown in this work, and Lieutenant Williams assisted in preparing the plans and estimates.

October 1 to December 1, 1901.—Engineer officer, Department of Northern Luzon.

December 1, 1901, to January 1, 1902.—Assistant engineer officer, Department of North Philippines.

December 23, 1901, to June 7, 1902.—Assistant to Board of officers to consider and report upon the subject of the defense of the important harbors of the Philippine Islands.

January 2, 1902.—With a detail of 25 enlisted men from Companies E and H, Second Battalion of Engineers, began a topographical survey

of the entrance to Manila Bay. The bulk of the work was done by stadia and transit in the hands of the enlisted men. The survey was completed, the notes plotted, and the contours sketched in on April 25, 1902.

The enlisted men of this survey detail deserve much praise. At all times they worked faithfully and endured great hardship. The difficulty of the jungle work was such that all of the natives deserted and three-fourths of the enlisted men were taken to the hospital with fever, dysentery, or injuries; but most of the latter insisted on returning to camp before they were really able to do so.

June 7, 1902.—Detached for a hydrographic survey of the harbor of Aparri and Cagayan River.

June 7 to 30, 1902.—Engaged in making plans of the sites selected for batteries on Manila Bay, and making preliminary examinations of the foundation soils, under verbal instructions from the chief engineer of the division.

June 19, 1902.—Assigned to Company F, Second Battalion of Engineers.

June 30, 1902.—Departed from Manila for Aparri on transport *Lawton* to make a survey estimate, and project for the improvement of the mouth of the Cagayan River, under the direction of the engineer officer of the Division of the Philippines. The survey to extend from the pueblo of Camalaningan to deep water at the bar of the river mouth. A party of two noncommissioned officers and nine privates of the Second Battalion of Engineers was organized and equipped for the work. The distance from Camalaningan to deep water over the bar at the river mouth is about 8 miles, and the Cagayan River is about a mile wide in this reach.

LIEUT. EARL I. BROWN.

June 25 to July 16, 1091.—On board transport *Hancock* en route from San Francisco, Cal., to Manila with Company F, Second Battalion of Engineers.

July 26 to August 23, 1901.—In temporary command of Company F, Second Battalion of Engineers.

August 31, 1901.—Left Manila on transport *Relief* and arrived at Iloilo, Panay, September 2, 1901, with Company F, Second Battalion of Engineers.

September 3 to November 30, 1901.—Assistant engineer officer, Department of the Visayas.

September 11, 1901.—Appointed engineer third district, Department of the Visayas, with station at Bacolod, Negros, P. I.

September 12, 1901.—Arrived at Bacolod with detachment of 28 men of Company F, Second Battalion of Engineers.

September 12, 1901, to February 27, 1902.—In charge of survey of the island of Negros.

October 19, 1901.—Engineer officer of Bacolod.

November 30, 1901.—Assistant engineer officer, Department of South Philippines.

February 27, 1902.—Relieved from duty on the island of Negros. Left Negros and arrived at Iloilo, Panay, and assumed charge of the engineering work on the island of Panay and the improvement of the harbor of Iloilo.

In charge of construction of roads and bridges, islands of Panay,

Paragua, and Cuyos. In charge of making surveys, plans, and estimates for the improvement of the harbor of Iloilo.

May 18, 1902.—Relieved from duty in island of Panay.

May 20, 1902.—In command of Company F, Second Battalion of Engineers, at Zamboanga, Mindanao.

LIEUT. AMOS A. FRIES.

June 25 to July 16, 1901.—On board transport *Hancock*, en route from San Francisco, Cal., to Manila, on duty with Company G, Second Battalion of Engineers.

July 18–21, 1901.—On duty with Company G, at Cuartel de Malate, Manila.

July 22 to August 30, 1901.—On special duty under the immediate orders of Major Sears, engaged in making large-scale contour survey and map of Government land in the vicinity of Fort San Antonio Abad, in eastern suburb of Manila, and in measuring masonry in and making estimates and plans for the tearing down of old wall of Manila from San Domingo gate to the Anda monument, including all of Fort Santiago. Final estimate submitted August 30, 1901.

August 31 to September 4, 1901.—On transport *Relief*, en route to Zamboanga, Mindanao, with Company G, Second Battalion of Engineers.

September 5 to October 8, 1901.—Engaged in making hydrographic survey of the shore line along the Zamboanga water front.

October 8, 1901.—On special duty with Company G, Second Battalion of Engineers, building a wharf at Zamboanga. The work was done by the enlisted men of the company.

May 16 to June 30, 1902.—In charge of the engineer office, Seventh Separate Brigade, Zamboanga.

LIEUT. JAMES A. WOODRUFF.

June 25 to July 16, 1901.—On board transport *Hancock*, en route from San Francisco, Cal., to Manila, adjutant and recruiting officer, Second Battalion of Engineers.

July 22, 1901.—Detailed as ordnance officer, Second Battalion of Engineers.

August 23, 1901.—Acting adjutant and ordnance officer, engineer garrison, post of Manila, and signal officer, Second Battalion of Engineers, and engineer garrison.

August 28 to September 4, and since September 29, 1901.—Acting quartermaster and commissary, Second Battalion of Engineers.

September 4, 1901.—Summary-court officer, engineer garrison, post of Manila.

September 10 to November 11, 1901.—In charge of survey of military zone near El Deposito. The military zone was established by order of the commanding general, Division of the Philippines, September 10, 1901. It comprises about 97 acres and is situated on the bank of the Rio Salapan, a branch of the Pasig River, about 3 miles from Intramuros, Manila. The survey was made by a detachment of 1 corporal and 8 privates under the command of Lieutenant Woodruff. The blue print made in 1892 by the Spanish authorities proved very inaccurate, and the boundary lines had to be run over again. A topographical map of the zone, with 5-foot contour lines, was made, and 33

marking stones were placed. Accurate deeds and descriptions of the adjoining property could not be obtained, but the line as marked is believed to be as near the true boundary as the information available would permit.

In general charge of the instruction of enlisted men in photography.

September 25 to November 23, 1901.—In charge of survey of the military zone around Polverino of San Juan del Monte.

October 11, 1901.—Intelligence officer, engineer garrison, post of Manila.

February 11 to March 28, 1902.—In charge of a topographical survey of a new military reservation for the proposed post of Manila.

April 17 to May 3, 1902.—Under the orders of Captain Harts, in charge of work on new post near Manila. Established a camp on the site with 30 enlisted men of the Second Battalion of Engineers on April 17. Commenced erection of barracks, mess hall and kitchen, and distilling plant. Commenced work on the roads for the new post and staked out location of buildings for one regiment of infantry. Made soundings in river for site of proposed wharf. From 50 to 200 native laborers employed. Relieved by Lieutenant Markham on May 3, 1902.

May 31, 1902.—Assumed charge of the photographic laboratory, office of the engineer officer, Division of the Philippines. In charge of instruction of Companies E and H in cavalry drill, reconnaissance, road sketching, map making, photography, etc.

June 29, 1902.—Commanding engineer garrison of Manila.

LIEUT. WILLIAM KELLY.

July 1 to September 20, 1901.—At Pili, Camarines Sur, P. I., in charge of road and bridge work in province of Camarines Sur, with detachment of 22 men of Companies B and D, First Battalion of Engineers. During this period about 2½ miles of road were finished and 15 bridges and 9 culverts built. During this time Lieutenant Kelly was attached to Company B, First Battalion of Engineers.

September 20, 1901.—Detached from Company B, First Battalion of Engineers; to remain in charge of repair of roads and bridges in provinces of Albay and Camarines Sur. Assumed immediate charge of the repair of road from Daraga to Ligao, taking over funds and property appertaining thereto. In command of detachment of 4 noncommissioned officers and 19 privates of Company H, Second Battalion of Engineers.

November 25–29, 1901.—Changed station from Pili, Camarines Sur, to Guinobatan, Albay, P. I.

December 31, 1901.—Placed in charge of district comprising provinces of North and South Camarines and Albay, to become acquainted with its topographic features, its needs and possibilities, and be prepared to examine or survey and report upon any project upon call from the office of the engineer officer, Department of North Philippines.

March 9, 1902.—Corpl. Hudson H. Bubar made the ascent of Mount Mayon, an active volcano, about 8,000 feet high. The ascent is extremely difficult and dangerous, because the sides of the volcano are loose sand and rock standing on the natural slope. A week later Corporal Bubar made the ascent again, as a guide for a party of four

officers of the Ninth Cavalry. Second Lieut. Robert M. Barton and Corporal Bubar were the only ones of the party to reach the top. They succeeded in taking several good photographs of the crater.

A number of scientific parties are reported as having attempted this ascent, but none ever succeeded in reaching the top, and several lives were lost in the attempts.

May 16, 1902.—Relieved from duty in the provinces of Camarines Sur and Albay and ordered to report to the engineer officer, Department of North Philippines, Manila, P. I.

May 31, 1902.—Work on the Daraga-Ligao road, province of Albay, ceased.

June 5, 1902.—Property transferred. Awaited transportation to Manila until June 29, 1902.

June 19, 1902.—Assigned to duty with Company E, Second Battalion of Engineers.

LIEUT. LEWIS H. RAND.

July 1 to December, 1901.—At Agno, Zambales, in charge of road and bridge work. Attached to Company A, First Battalion of Engineers.

July 11, 1901.—Relieved from duty with Company A and assigned to Company D, First Battalion of Engineers.

September 20, 1901.—Detached from Company D, First Battalion of Engineers.

December, 1901, to January 19, 1902.—At Calasiao, Pangasinan, in charge of road and bridge work in provinces of Pangasinan, Zambales, and Benguet.

January 19, 1902.—Changed station to Dagupan. Relieved Lieutenant Spalding of charge of road and bridge work in provinces of Pangasinan, Zambales, and Benguet.

June 19, 1902.—Assigned to Company H, Second Battalion of Engineers.

LIEUT. EDWARD M. MARKHAM.

July 1, 1901.—Quartermaster and commissary, Second Battalion of Engineers.

September 29, 1901, to March 27, 1902.—On detached service investigating coal deposits of the Philippine Islands. With a detail of five enlisted men left Manila September 29 and inspected coal deposits on islands of Batan, Cebu, and Negros. Found the coal of the Philippines to be not true Paleozoic coal, but lignites varying widely in value as fuel. Recommended that the Government acquire certain coal property on Batan Island for purposes of experiment.

May 3, 1902.—Relieved Lieutenant Woodruff of local charge of preliminary work of construction of the new military post near Manila. Engaged in the erection of temporary barracks, mess hall, stables, and wharf; in the construction and laying out of roads and of target range; and in surveying the portion of the Pasig and Taguig rivers bordering the reservation.

LIEUT. GEORGE B. PILLSBURY.

June 25 to July 16, 1901.—On board transport *Hancock*, en route from San Francisco, Cal., to Manila, P. I., with Company E, Second Battalion of Engineers.

July 25 to August 8, 1901.—Commanding Company E, Second Battalion of Engineers.

August 12, 1901, to January 20, 1902.—At Pasig, Rizal Province, in charge of road and bridge work in the Department of Northern Luzon. During this period the road from Rosario to Cainta was repaired, the work being completed January 15, 1902, this road being 2 miles long, running through low, wet ground. About one-half of the road is repaired with a cheap telford construction, the remainder with gravel. The road is liable to floods, which makes its duration problematical.

The approaches to the ferry over the Pasig River, near Pasig, P. I., were rebuilt and repaired. The road from the ferry landing to the town of Pasig was repaired, the work being completed January 15, 1902, this road being about one-half mile long and flooded every rainy season.

Work was also done on the repair of the San Felipe Neri road, this work being turned over to Lieutenant Johnston on January 13, 1902.

January 26, 1902.—Arrived at Batangas, Batangas Province, P. I., and assumed charge of the engineer work of the Third Separate Brigade. This work comprises the road from Tanauan to Batangas, a distance of about 30 miles.

In charge of engineering work in the provinces of Batangas, Laguna, and Tayabas, Island of Luzon, P. I., with Lieutenant Caples as assistant. Stationed at Calamba, Laguna.

LIEUT. GUSTAVE R. LUKESH.

June 25 to July 16, 1901.—On board transport *Hancock*, en route from San Francisco, Cal., to Manila, P. I., on duty with Company H, Second Battalion of Engineers.

August 9, 1891.—At Iligan, Isabela Province, in command of a detachment of 3 noncommissioned officers and 15 privates of Company E, Second Battalion of Engineers, repairing the road from Iligan to Bayombong.

At Cauayan, Isabela Province, in local charge of all engineering work under the direction of the office of the engineer officer of the Department of North Philippines, in the district comprised of the provinces of Isabela, Cagayan, and Nueva Viscaya, Luzon, P. I. Commanding detachment of Company E, Second Battalion of Engineers.

LIEUT. JOHN R. SLATTERY.

July 1-20, 1901.—In charge of road and bridge work at Infanta, P. I. Attached to Company C, First Battalion of Engineers.

July 21 to August 21, 1901.—At Dasol, Zambales, in charge of road and bridge work.

August 22 to October 25, 1901.—At San Isidro, Zambales, in charge of road and bridge work.

September 20, 1901.—Detached from Company C, First Battalion of Engineers.

October 25-31, 1901.—En route to Vigan, Ilocos Sur, to take charge of road and bridge work in provinces of North and South Ilocos, Abra, Bontoc, Lepanto, and Union, island of Luzon, P. I.

June 19, 1902.—Assigned to Company G, Second Battalion of Engineers.

LIEUT. CURTIS W. OTWELL.

April 9, 1902.—Transferred to the Corps of Engineers, to date from January 18, 1902, with rank from February 2, 1901.

June 19, 1902.—Assigned to Company H, Second Battalion of Engineers. Engaged in making survey of harbor of Calbayog, Samar, preliminary to construction of pier.

LIEUT. HUBERT L. WIGMORE.

March 7, 1902.—Transferred to the Corps of Engineers, to date from January 18, 1902, with rank from February 2, 1901.

March 30 to May 19, 1902.—Engineer officer, Lake Lanao expedition.

June 19, 1902.—Assigned to Company G, Second Battalion of Engineers.

LIEUT. EDWARD N. JOHNSTON.

June 25 to July 16, 1901.—On board transport *Hancock*, en route from San Francisco, Cal., to Manila, P. I., on duty with Company E, Second Battalion of Engineers.

August 9, 1901.—In command of Company E, Second Battalion of Engineers.

September 23 to November 12, 1901.—In charge of improvement of the Manila-Malabon road. Some of the repairs were carried on under the supervision of Lieutenant Spalding. The work was stopped November 12, 1901, the appropriation being nearly exhausted. The road was then in good condition for military purposes.

January 3, 1902.—Placed in charge of road and bridge work in province of Cavite.

January 17, 1902.—Relieved Lieutenant Pillsbury of charge of road and bridge work in provinces of Rizal, Bulacan, Infanta, Morong, and Manila.

LIEUT. CLARENCE O. SHERRILL.

July 1–12, 1901.—At Humingan, P. I., in charge of road and bridge work. Attached to Company D, First Battalion of Engineers.

July 12–27, 1901.—At Dagupan with Company A, First Battalion of Engineers.

July 27, 1901.—Arrived at San Isidro, province of Nueva Ecija, and relieved Lieut. D. C. Lyles, Twelfth Infantry, of funds and property pertaining to road and bridge work lately in the charge of Lieutenant Altstaetter.

August 23, 1901, to March 12, 1902.—At Angeles, Pampanga, in charge of repairs on road from Angeles to Dinalupijan.

September 20, 1901.—Detached from Company D, First Battalion of Engineers.

In charge of engineering work in provinces of Bataan and Pampanga, island of Luzon, P. I., with station at San Fernando, Pampanga.

In charge of a transit and stadia survey of the Iba-O'Donel trail.

June 19, 1902.—Assigned to Company H, Second Battalion of Engineers.

LIEUT. ERNEST D. PEEK.

June 25 to July 16, 1901.—On board transport *Hancock*, en route from San Francisco, Cal., to Manila, P. I., on duty with Company G, Second Battalion of Engineers.

August 6 to September 16, 1901.—On special duty with Lieutenant Dent and 15 enlisted men making survey of proposed site for the new post of Manila. The work was accompanied with difficulty, owing to the great amount of rain and the dense vegetation.

September 16–30, 1901.—On board transport *McClellan*, en route to join his company at Zamboanga, Mindanao.

October 5, 1901.—With 20 men of Company G proceeded to Parang, Mindanao, for work in the field. A trail from Parang to Malabang, a distance of 32 miles through the mountains, was built by members of the detachment. A thorough search was made for the remains of the old Spanish road between Pollok and Cottabato, with a view to utilizing it in the selection of a route for a road from Parang to Cottabato. Also a route was selected over entirely new ground, and map and estimates for cost of construction by using the Spanish road and of the proposed route were submitted. The proposed route was accepted and $45,000, Mexican currency, was appropriated from the public civil funds to carry on the work. Actual work of construction was begun January 15, 1902, and it will probably take about fifteen months from that date to complete same. The length is 13 miles, and the ground is unbroken and a large part is hills composed of rock. Labor is a very difficult problem, the laborers being Moros, who are very indolent.

LIEUT. GEORGE R. SPALDING.

July 1 to September 23, 1901.—In command of Company C, First Battalion of Engineers, and in charge of repairs to Caloocan-Manila, Malolos-Baliuag, Baliuag-Gapan, and Baliuag-Angat roads, under immediate orders of the engineer officer of Department of Northern Luzon. Completed Baliuag-Gapan, Baliuag-Angat, and Malolos-Baliuag roads (allotment expended) August 31, 1901.

September 23, 1901.—Relieved of Caloocan-Manila road by Lieut. E. N. Johnston, and of command of Company C by Lieutenant Burgess.

September 26, 1901.—Relieved Captain Cavanaugh of road and bridge work in Department of Northern Luzon, with headquarters at Dagupan. In command of detachment of 8 men.

January 19, 1902.—Relieved of road work at Dagupan by Lieutenant Rand.

January, 1902.—With detachment of 8 men proceeded from Dagupan to Tarlac, Tarlac Province, and assumed charge of road and bridge work in provinces of Tarlac and Nueva Ecija. Built 5 miles of road from Tarlac to Victoria without surfacing. Upon withdrawal of troops from Victoria moved headquarters at San Isidro, Nueva Ecija.

June 19, 1902.—Assigned to Company E, Second Battalion of Engineers.

LIEUT. ELLIOTT J. DENT.

June 25 to July 16, 1901.—On board transport *Hancock*, en route from San Francisco, Cal., to Manila, P. I., on duty with Company H, Second Battalion of Engineers.

August 7 to September 16, 1901.—On special duty as assistant to Lieutenant Peck in survey of military reservation near El Deposito.

September 4, 1901.—Transferred from Company H to Company F, Second Battalion of Engineers.

September 17 to October 11, 1901.—En route to Iloilo, Panay.

October 11–29, 1901.—On duty with Company F, Second Battalion of Engineers.

October 29 to November 3, 1901.—Changed station to Cebu, Cebu.

November 3 to December 22, 1901.—At Cebu, Cebu, engaged in topographical work. In command of a detachment of 3 men of Company F. The object of the survey was to fill in and complete the map of the island, which was very incomplete and unreliable.

December 23, 1901, to February 17, 1902.—At Iloilo, Panay, in command of a detachment of 30 men of Company F, Second Battalion of Engineers, in charge of engineering work on the island of Panay.

February 17, 1902, to May 18, 1902.—On island of Negros in charge of engineering work.

May 17, 1902.—Rejoined Company F, island of Mindanao.

LIEUT. WILLIAM G. CAPLES.

July 1 to December 31, 1901.—In charge of road and bridge work with station at Calamba, P. I., comprising work on Calamba-Tanauan road, and Calamba-Banan road, the latter road being assigned him September 6, 1901. In charge of rebuilding burned bridge between Santo Tomas and Alaminos. In charge of salvaging gunboat *Portland* sunk in Lake Taal. Assumed charge November 25, 1901, of the repairs to the Santa Cruz-Magdalena road.

January 6–27, 1902.—At Lipa, Batangas Province, P. I., in charge of road and bridge work in provinces of Laguna, Batangas, and Tayabas. Inspected and made plans for building road from Calamba to Cabuyao and Santa Rosa. Inspected, prepared estimate on, and organized work on road from San Juan de Bocboc to San Juan Viego. Relieved January 27, 1902, of all duties except Calamba-Batangas road by Lieutenant Pillsbury.

January 26, 1902.—Assistant to Lieutenant Pillsbury in connection with engineering work in provinces of Batangas, Laguna, and Tayabas, with station at Lipa.

June 19, 1902.—Assigned to Company H, Second Battalion of Engineers.

LIEUT. ARTHUR WILLIAMS.

June 25 to July 16, 1901.—On board transport *Hancock*, en route from San Francisco, Cal., to Manila, P. I., on duty with Company F, Second Battalion of Engineers.

July 24, 1901.—Assigned to duty in the office of the chief engineer officer, Division of the Philippines, in connection with the purchase and issue of material for roads and bridges.

September 4, 1901.—Transferred from Company F to Company H, Second Battalion of Engineers.

November 30, 1901.—In charge of compiling and issuing maps of the Philippines.

June, 1902.—Assistant to the Board of officers to consider and report upon the subject of the defense of the important harbors of the Philippine Islands.

RIVER AND HARBOR IMPROVEMENTS.

Appropriations.—The funds with which the works for the improvement of rivers and harbors were prosecuted during the last fiscal year were derived from the appropriations made by the sundry civil act, approved March 3, 1901; the river and harbor act, approved June 13, 1902; the sundry civil act, approved June 28, 1902, and from such balances of former appropriations as were available.

The following works are provided for by permanent appropriations: Removing sunken vessels; operating and care of dredge boats on Upper Mississippi River; removing obstructions in Mississippi River; gauging waters of Lower Mississippi River and its tributaries; examinations and surveys at South Pass, Mississippi River; maintenance of South Pass Channel, Mississippi River; operating snag boats on Ohio River; operating and care of canals, etc.

Status of works.—Statements derived from the reports of the officers in charge of the various works, and given herewith, set forth the condition of each improvement and the extent of the work performed during the past fiscal year.

Expenditures.—The total amount actually expended under the direction of the Chief of Engineers in connection with the improvement of rivers and harbors during the fiscal year ending June 30, 1902, is as follows:

Rivers and harbors (general, including examinations, surveys, and contingencies)	$12,939,224.71
Removing sunken vessels	27,184.58
Operating snag and dredge boats on Upper Mississippi River	25,000.00
Removing obstructions in Mississippi River	92,639.67
Gauging waters of Lower Mississippi River and its tributaries	5,885.82
Maintenance of South Pass channel, Mississippi River	99,528.27
Operating snag boats on Ohio River	43,959.61
Operating and care of canals, etc	1,098,560.41
Prevention of deposits in New York Harbor	69,841.28
California Débris Commission	9,703.77
Total	14,411,528.12

This amount does not include the following:

1. Expenditures under Mississippi River Commission	$861,579.41
2. Expenditures under Missouri River Commission (including Osage and Gasconade rivers)	28,039.75
3. Enlargement of Governors Island, New York Harbor	109,499.99

Estimates.—The following estimates are submitted by the Chief of Engineers for the fiscal year ending June 30, 1904:

Under continuing contracts	$18,570,339.33
Under California Débris Commission	15,000.00
Prevention of deposits in New York Harbor	120,260.00
Enlargement of Governors Island, New York Harbor	400,000.00

The Mississippi River Commission submits an estimate amounting to $2,560,000.

With the understanding that the river and harbor act approved June 13, 1902, is a biennial act and that consideration will not be given to appropriations, except in case of continuing contracts, at the second session of the Fifty-seventh Congress, no estimates for river and harbor works (general) are submitted by the Chief of Engineers.

Reports relative to improvement of rivers and harbors by municipalities, private corporations, or individuals, etc.—Section 13 of the river and harbor act of June 13, 1902, provides, inter alia, that—

The Secretary of War is authorized and directed to ascertain, so far as practicable, and report to Congress, all cases in which improvements on navigable waters of the United States have been or are being undertaken by municipalities, private corporations, or individuals, either alone or in conjunction with the Government, and information shall be furnished in such report relating to all cases of improvement of harbors and rivers by the United States in connection with which, the work of improvement, under approved projects, has included or will include inner harbors, or portions of rivers or inlets within shore lines or corporate city limits, or channels adjacent to wharves.

For detail reports by the district officers on this subject reference is made to Appendix A A A.

Engineer divisions.—The engineering works in the charge of this office are arranged in nine divisions, and officers of the Corps of Engineers were assigned as division engineers to overlook these works, as follows:

West of the Rocky Mountains: Pacific Division, Col. Jared A. Smith to September 23, 1901, and Lieut. Col. D. P. Heap since that date; Northern Pacific Division, Lieut. Col. W. H. Heuer since September 23, 1901. East of the Rocky Mountains: Northeast Division, Col. Chas. R. Suter; Eastern Division, Col. S. M. Mansfield; Southeast Division, Col. Peter C. Hains; Gulf Division, Lieut. Col. H. M. Adams; Western Division, Col. Amos Stickney; Central Division, Lieut. Col. Thos. H. Handbury to January 15, 1902, and Col. G. J. Lydecker since that date; Northwest Division, Col. S. M. Mansfield to July 24, 1901, and Lieut. Col. O. H. Ernst since that date.

Preliminary examinations and surveys.—The river and harbor act approved June 13, 1902, provides for preliminary examinations and surveys of certain localities, and the duty of making the same has been assigned to Boards of Engineers, and officers of the Corps of Engineers in charge of the various engineering districts. Reports thereon will be duly submitted when received.

ATLANTIC COAST AND GULF OF MEXICO.

IMPROVEMENT OF RIVERS AND HARBORS IN MAINE EAST OF AND INCLUDING PORTLAND HARBOR.

This district was in the charge of Maj. S. W. Roessler, Corps of Engineers, having under his immediate orders Capt. Charles W. Kutz, Corps of Engineers, to October 31, 1901. Division Engineer, Col. Chas. R. Suter, Corps of Engineers.

1. Lubec Channel, Maine.—This channel lies between the eastern extremity of the State of Maine and Campobello Island, Canada.

Originally the channel was about 5 feet in depth at mean low tide and 2 feet at low water of spring tides, the mean range in tide being 18.2 feet. A project was adopted in 1879, which, as subsequently modified, provided for a channel 275 feet wide, increasing to 300 feet in the bends, and 12 feet deep at mean low tide. This project was completed in 1890 practically as proposed. The present project was adopted in 1894, and its object was to widen the existing channel to a least width of 500 feet, at an estimated cost of $150,000.

The expenditures to June 30, 1902, amounted to $168,954.68 on the old project and $96,528.50 on the present project. At that date the channel had been widened to the projected width, except at the lower portion of the channel, where a strip about 3,900 feet long and about 130 feet in average width remains to be excavated in order to com-

plete the improvement. It is proposed to complete this improvement under the appropriation of $53,000 contained in the river and harbor act of June 13, 1902.

This channel is an international one, and the benefits from the improvements are almost entirely general. As the tidal currents are very strong and dense fogs prevail a large part of the time, the widening of the channel decreases the chances of stranding and collision.

The commerce is reported as follows:

	Tons.		Tons.
1896	52,300	1899	126,700
1897	53,400	1900	76,800
1898	87,000	1901	165,000

The increased tonnage for 1901 is due to a remarkably busy season by the fishing interests.

July 1, 1901, balance unexpended	$639.18
Amount appropriated by river and harbor act approved June 13, 1902	53,000.00
	53,639.18
June 30, 1902, amount expended during fiscal year	122.36
July 1, 1902, balance unexpended	53,516.82
July 1, 1902, outstanding liabilities	100.00
July 1, 1902, balance available	53,416.82

(See Appendix A 1.)

2. *Narraguagus River, Maine.*—The navigable portion of the river is 7 miles in length. The town of Millbridge is located about 2 miles above its mouth, and the lumber town of Cherryfield at the head of navigation. The mean range of tide is 11.3 feet.

Before improvement the river was obstructed from its mouth to Millbridge by a bar having a depth of 6 feet at mean low tide and less than 4 feet at extreme low tide. Between Millbridge and Cherryfield the river was obstructed by bowlders and ledge.

The original project upon which the first appropriation was made is set forth in the district officer's report of December 8, 1870, and provided only for the betterment of navigation above Millbridge by the removal of obstructions, such as mill waste, sunken bowlders, and the construction of an iron spindle on Half Tide Rock. This work was completed in 1874. The amount expended was $22,000 and the resulting improvement is said to have been of great benefit to navigation.

The improvement of the river below Millbridge was provided for by project submitted in 1880. Its object was to dredge a channel 200 feet wide and 11 feet deep as far up as Long Wharf, and 9 feet thence to the anchorage known as Deep Hole. The estimated cost was $50,000, and appropriations aggregating this amount were made between 1886 1899.

The amount expended on the latter project to the end of the fiscal year 1902 was $49,583.81; but the project was not completed as originally projected, a change having been made necessary by the abandonment of Long Wharf by the steamboat company and the erection of a new wharf farther down the river. This change of location of the steamboat wharf rendered unnecessary any further dredging above that point, and accordingly the last appropriation was expended in dredging in front of the wharf and between that point and the deep water of the bay. In obtaining a depth of 11 feet to the steamboat wharf where

it is now located, the main object of the improvement has been accomplished. The work is only temporary; the material excavated was a mixture of sawdust and mud and will be replaced in the course of a few years by a new deposit of the same material. It is reported that the portion of the river in front of the wharf has already shoaled to a depth of 7 feet at mean low tide.

The commerce for the last eight years is given as follows:

	Tons.		Tons.
1894	95,600	1898	26,147
1895	54,750	1899	23,545
1896	16,175	1900	35,825
1897	41,500	1901	41,934

July 1, 1901, balance unexpended	$416.19
July 1, 1902, balance unexpended	416.19
July 1, 1902, outstanding liabilities	50.00
July 1, 1902, balance available	366.19

(See Appendix A 2.)

3. Breakwater from Mount Desert to Porcupine Island, Bar Harbor, Me.—The object of the breakwater is to protect the wharves of Bar Harbor and the anchorage in front of the town from the heavy seas of southerly gales.

The present project is the original one approved June 14, 1889, modified as to length of breakwater by the revised project of 1893. It provides for a breakwater of riprap stone, extending from Porcupine Island a distance of 2,500 feet in a westerly direction to a point about 600 feet from the low-water line of Mount Desert Island, the estimated cost being $420,200.

The expenditures to June 30, 1902, were $189,789.18, by which date the breakwater had been raised to a height of mean high tide for a distance of 1,790 feet from Porcupine Island. The width on top is 20 feet and the side slopes are such as the rock naturally assumes. It is proposed to expend future appropriations in extending the breakwater to the same height and section until the projected length is reached. After that the question of strengthening the sea slope and raising the breakwater will be considered.

The beneficial effects resulting from the portion of the breakwater already built in protecting the wharves at Bar Harbor and the anchorage basin are appreciably felt; but in order to secure the desired protection at high water of spring tides it will probably be found necessary to raise the breakwater to a height of about 6 feet above mean high tide. The mean range in tides is 11.5 feet.

The benefits to navigation are general in providing a harbor of refuge, and local in making it possible for boats to land at the wharves at all times with safety. The only convenient method of transportation to and from Bar Harbor is by boat.

No operations beyond inspection have been carried on during the fiscal year.

The commerce has been reported as follows:

	Tons.
1898	22,175
1899	24,393
1901	42,150

July 1, 1901, balance unexpended	$291.28
June 30, 1902, amount expended during fiscal year	80.46
July 1, 1902, balance unexpended	210.82
July 1, 1902, outstanding liabilities	50.00
July 1, 1902, balance available	160.82

(See Appendix A 3.)

4. Harbor at Sullivan Falls, Maine.—Sullivan River has a length of about 6 miles and is the outlet of a large bay. About midway of its length a point of land projects to such extent as to reduce the width to about one-fourth that immediately above and below, and at this place the slope and velocity are such that the locality is termed Sullivan Falls. The bottom is ledge, the higher portions forming dangerous obstructions to navigation. Hatchers Rock, about midway of the narrow channel at the falls, had originally only about 6 inches of water over it at mean low tide. The mean range in tides is 11.5 feet.

Under a project set forth in report of the district engineer dated December 10, 1870, and under appropriations based thereon, the sum of $35,000 was expended in removing three old piers, in excavating the obstructing ledges at the falls to a depth of 7 feet at mean low tide, and in replacing spindles on two rocks near the mouth of the river. This work was completed in 1875 and was of material benefit to navigation.

The present project is that referred to in the river and harbor act of June 3, 1896, as the "approved project," and published in House Ex. Doc. No. 84, Fifty-first Congress, second session, and in the Annual Report of the Chief of Engineers for 1891, page 619. It provides for removing Hatchers Rock and two other points of ledge to a depth of 10 feet at mean low tide, at an estimated cost of $35,000.

The expenditures under the existing project to June 30, 1902, were $9,535.31, and the operations consisted in removing the entire area of Hatchers Rock and a part of the outer end of ledge "C" to a depth of 10 feet at mean low tide.

The improvement not only increases the navigable depth, but also, by removing the cause of eddies and cross currents, has added to the length of time at each high and low tide during which vessels may pass through the rapids with safety.

Vessels can not use the channel at low stages except when the tide is slack. This occurs after the tide has flowed about 2 feet, at which time vessels drawing 11 feet can pass through safely.

The improvement may be regarded as permanent.

It is proposed to apply the additional appropriation of June 13, 1902, in removing a part of the outer end of ledge "C."

The commerce for the last six years has been as follows:

	Tons.		Tons.
1896	51,290	1899	42,125
1897	50,790	1900	35,926
1898	41,700	1901	49,125

July 1, 1901, balance unexpended	$464.69
Amount appropriated by river and harbor act approved June 13, 1902	5,000.00
July 1, 1902, balance unexpended	5,464.69
July 1, 1902, outstanding liabilities	50.00
July 1, 1902, balance available	5,414.69

(See Appendix A 4.)

5. Union River, Maine.—The navigable portion of the river extends from the head of Union Bay to the foot of the falls at Ellsworth, a distance of about 3¾ miles.

Before improvement the channel was obstructed by a large deposit of slabs, edgings, and sawdust near Ellsworth, which practically suspended navigation, except at high tide, by projecting ledges in the narrows about three-fourths of a mile below the wharves at Ellsworth, by bowlders at several points along the channel, and by a broad, flat bar of sawdust and mud at the mouth.

The first project for the improvement of the river is contained in the report of the district officer, dated June 30, 1867, and provided for erecting beacons, removing sunken ledges and bowlders, and dredging mill waste near Ellsworth, so as to secure a depth of 3 feet at mean low tide, this being the available depth on the bar at the mouth of the river. This improvement was completed in 1873 with an expenditure of $30,000.

A survey was made in 1889 under the provisions of the act of 1888, and a new project was submitted with a view to obtaining a depth of 6 feet at mean low tide from the wharves at Ellsworth to deep water in the bay. This depth was to be obtained by dredging mill waste near Ellsworth, by removal of ledge in the Narrows, and by dredging across the bar at the mouth of the river. To maintain the improved depth at the latter point, the same project provided for the construction of a training wall to concentrate the ebb flow in the channel. The present authorized project is that described above with the training wall omitted, and is published on page 461, Part I, Annual Report of the Chief of Engineers for 1890.

The act of June 3, 1896, appropriated $15,000 for beginning the improvement. This sum was expended in excavating to a depth of about 6 feet over a section of river about 3,000 feet long in the vicinity of the Narrows, and in carrying a single cut of the dredge to the same depth as far up as the wharves, to afford immediate relief to navigation. This single cut was partly filled with new deposit by the next freshet.

By the act of March 3, 1899, the sum of $15,000 was appropriated and a contract was authorized for completing the improvement at an additional cost of $115,000.

Changes having occurred since the making of the survey upon which the project was based, a new survey was made in May, 1899, and a project for securing the completion of the improvement, with such changes in quantities as were shown to be necessary by the survey, was approved by the Secretary of War June 28, 1899.

A contract for the entire work was made October 16, 1899, and is still in progress. The working season is short, beginning after the spring freshets in May and ending with the appearance of ice in November or December.

The amount expended upon this project to June 30, 1902, was $106,441.69.

The status of the work at that time was as follows: The channel across the bar at the mouth had been excavated to a depth of 6 feet, with a width of 200 feet for a distance of 600 feet, and a width of 120 feet for a further distance of 3,200 feet. The ledge work at the Narrows had been about 80 per cent completed, and the excavation of mill waste in vicinity of Ellsworth was in progress.

The material removed to June 30, 1902, under the present project was:

Mill waste, slabs, etc., 108,574 cubic yards during the year and 164,500 cubic yards under the contract.

Hardpan and bowlders, 6,975 cubic yards during fiscal year, 7,644 cubic yards under the contract.

Ledge, 5,420 cubic yards during the year, 6,400 cubic yards under the contract.

Sawdust and mud at mouth of river, 26,755 cubic yards during the year, 75,360 cubic yards under the contract.

Except in the Narrows and for a short distance above and below the increased depth obtained by the improvement has not been permanent. The bar at the mouth has shoaled at one point from 6 to 3 feet at mean low tide, and the channel excavated through the deposit of mill waste just below the wharves at Ellsworth was so filled in by new deposits during the spring freshet of 1902 as to practically reduce the channel to the same conditions as to depth as existed prior to the beginning of the improvement.

It is proposed to expend the balance of the available funds in completing the ledge work in the Narrows, and completing as nearly as possible the dredging in the vicinity of the wharves and between the wharves and the Narrows.

The mean range in tide is 11.5 feet.

The commerce for the last six years is as follows:

	Tons.		Tons.
1896	54,000	1899	49,800
1897	57,685	1900	42,580
1898	50,462	1901	37,749

The falling off has been principally in lumber and wood products.

July 1, 1901, balance unexpended	$116,232.83
June 30, 1902, amount expended during fiscal year	77,674.52
July 1, 1902, balance unexpended	38,558.31
July 1, 1902, outstanding liabilities	9,604.67
July 1, 1902, balance available	28,953.64
July 1, 1902, amount covered by uncompleted contracts	26,351.70

(See Appendix A 5.)

6. Bagaduce River, Maine.—This is a small stream that empties into Penobscot Bay at Castine, Me. The upper part of the river divides into two branches, one called Northern Bay and the other South Bay. Northern Bay, near South Penobscot, is a shoal sheet of water of about 700 acres area, the bottom of which for the greater part is bare at low tide. Before improvement there was a narrow channel from Bridges Point to Bowden's wharf, which had a depth of less than 2 feet and was obstructed by ledges and bowlders near Winslows Island. The South Bay is obstructed by ledges at Johnsons Narrows. Mean rise and fall of tide, 9.8 feet.

The approved project is understood to be that published in House Ex. Doc. No. 157, Fiftieth Congress, first session, and at page 398 of the Annual Report of the Chief of Engineers for 1888. Its object is to secure a channel 100 feet wide and 6 feet deep at mean low tide from Bridges Point, Northern Bay, to Bowden's wharf, at an estimated cost of $45,000. The same project provides for removing a small quantity

of rock in the channel at Johnsons Narrows, at an estimated cost of $1,875. All work done has been in accordance with this project.

The expenditures to June 30, 1902, were $24,652.19. At that date there had been obtained by dredging and by the removal of rocks and bowlders, mainly at Winslows Island, which was the shoalest place, a channel 40 feet wide and about 2 feet deep at mean low tide. No operations were carried on during the past year.

Navigation has not been appreciably benefited by the improvement. The improvement is of doubtful public benefit.

It is proposed to apply the appropriation of June 13, 1902, in continuing the removal of bowlders at Winslows Island and in dredging.

The commerce for the last eight years is given as follows:

	Tons.		Tons.
1894	67,850	1898	79,965
1895	85,900	1899	89,500
1896	78,050	1900	86,000
1897	86,600	1901	95,900

Probably the greater part of this pertains to Castine, at the mouth of the river. The increase has been chiefly in lumber and cooperage.

July 1, 1901, balance unexpended	$347.81
Amount appropriated by river and harbor act approved June 13, 1902	3,000.00
July 1, 1902, balance unexpended	3,347.81
July 1, 1902, outstanding liabilities	100.00
July 1, 1902, balance available	3,247.81

(See Appendix A 6.)

7. *Penobscot River, Maine.*—Except the dredging of a sawdust bar opposite High Head, near Bucksport, Me., the improvements have been confined to a stretch of about 3½ miles of the river at and below Bangor. Before improvement this part of the river was obstructed by ledge, bowlders, and mill waste to such extent as to afford a safe available depth of only about 6 feet at extreme low tide. The mean range in tides is 13.1 feet.

The original project is given in the district officer's report of August, 1870, and was approved August 22, 1870. Its object was to obtain, by dredging and by removing obstructing ledges and bowlders over 3½ miles of river at and below Bangor, an unobstructed channel having a width of 150 feet and a depth of 12 feet at the lowest tides. There was expended prior to the adoption of the present project $198,300.

The present project is an extension and modification of that of 1870. It is based on a survey ordered by the act of September 19, 1890, and its object is to secure a channel depth of 11 feet at extreme low tide for a width of 360 feet in Bangor Harbor; to widen, straighten, and deepen the channel near Crosbys Narrows and Stern's mill to a depth of 12 feet at extreme low tide; and to secure a depth of 22 feet at mean low tide between Bucksport and Winterport, at an estimated cost of $440,000.

In 1899 the project was extended to include certain work at Bangor Harbor, estimated to cost $28,000.

The expenditures under the existing modified and enlarged project to June 30, 1902, amounted to $169,327.13, and the object of the general project has been virtually accomplished.

The available depths are as follows: Bangor Harbor, 14 feet at

mean low tide, or 11 feet at extreme low tide; at Stern's mill and Crosbys Narrows, 15 feet at mean low tide, or 12 feet at extreme low tide. The shoal at Frankfort flats was dredged to 22 feet at mean low water and, so far as known, has given no trouble since. The shoal at High Head above Bucksport was dredged to the same depth, but afterwards shoaled up to a certain extent and subsequently deepened again by the natural scour of the river. Examination made since the dredging was done shows that the depths on the bar vary and that no material benefit has been obtained by dredging.

In view of the shifting character of this bar, the utter failure to obtain a permanent improvement by dredging, and the fact that it is not in any way a dangerous obstruction to navigation, no further work is recommended upon it at this time.

In the act of March 3, 1899, Congress adopted a project for further local improvement in Bangor Harbor, the object being to remove the ledge in front of the Boston and Bangor Steamboat Company's wharf to a depth of 11 feet at extreme low tide, and to deepen the basin of the Kenduskeag stream at its junction with the Penobscot River. As approved by the Secretary of War, May, 1899, the detailed plan of improvement of the Kenduskeag River, under the general project adopted by the act of March 3, 1899, contemplated dredging through both draws of the railroad bridge, and within the basin between the lower bridge and the post-office bridge, so as to obtain a uniform depth of about 2 feet below mean low water to within 30 feet of the wharf.

The contract for both improvements was in force at the beginning of the past year, and was completed during the year by the removal of 2,225 cubic yards of ledge in front of the Boston and Bangor Steamboat Company's wharf and 15 cubic yards of bowlders and 27,428 cubic yards of gravel and sand from the basin of the Kenduskeag stream. The improvement at the Boston and Bangor Steamboat wharf is permanent; that in the mouth of the Kenduskeag not so. The depth it was expected to obtain in the latter was 2 feet below mean low water, but the available depth secured is in fact less than this on account of bowlders brought in by freshets and scattered over the basin.

When the ice began to move out in the latter part of March, 1902, an ice gorge was formed above the head of the Narrows, which, with an auxiliary gorge higher up in the vicinity of High Head at the lower part of the city, caused the water in Bangor Harbor to reach the highest level known since 1856, flooding the railroad station and tracks of the Maine Central Railroad, all the wharves, and all the business streets and basements adjacent to the basin of the Kenduskeag stream. From an observation made after the freshet by the engineer department of the Maine Central Railroad, it was estimated that the height of the flood was approximately 25 feet above mean low water or 12 feet above mean high tide. During the same freshet one span of the wagon bridge and the middle pier and two adjacent spans of the Maine Central Railroad bridge were carried away.

The commerce of the river for the last eight years is given as follows:

	Tons.		Tons.
1894	750,313	1898	639,671
1895	617,859	1899	658,632
1896	715,911	1900	917,835
1897	790,698	1901	708,012

July 1, 1901, balance unexpended	$19,447.50
June 30, 1902, amount expended during fiscal year	10,774.63
July 1, 1902, balance unexpended	8,672.87
July 1, 1902, outstanding liabilities	40.00
July 1, 1902, balance available	8,632.87

(See Appendix A 7.)

8. Bucksport Harbor, Maine.—The mean range in tide is 10.6 feet. Before improvement the bed of the river on the east side in front of the wharves of Bucksport was obstructed by a deposit of sawdust and mud, having a minimum depth of about 4 feet at mean low tide.

Under appropriations aggregating $16,500, this obstructing shoal, locally known as the Middle Ground, was dredged between 1875 and 1878 under the general project for improving Penobscot River, to a depth of 12 feet at mean low tide over that portion of its area lying immediately in front of the wharves, and to a depth of 8 feet over the remainder.

The existing project is based upon a report of a survey printed in House Doc. No. 275, Fifty-sixth Congress, first session, and reprinted in the Annual Report of the Chief of Engineers for 1900, page 1103, and was adopted by the act of June 13, 1902. It provides for removing the Middle Ground, which has again shoaled, to a depth of 16 feet at mean low tide, at an estimated cost of $20,000.

No work has yet been done on the existing project.

Amount appropriated by river and harbor act approved June 13, 1902	$20,000.00
July 1, 1902, balance unexpended	20,000.00

(See Appendix A 8.)

9. Camden Harbor, Maine.—The mean range in tide is 9.7 feet. Before improvement navigation was impeded by shoal water, there being a depth of about 6 feet in the outer harbor at the steamboat landing and less than 1 foot in the inner harbor, where most of the wharves are located.

The first project is contained in the district officer's report of December 17, 1872, and provided for dredging two channels, one 1,500 feet long, 100 feet wide, and 7 feet deep at mean low water on the easterly side of the harbor, the other 1,400 feet long, 100 feet wide, and 7 feet deep at mean low water. This improvement was completed in 1875, under appropriations aggregating $30,000 made by acts of 1873, 1874, and 1875.

The harbor was again surveyed and a new project submitted in 1887, under the provisions of the river and harbor act of 1886. This project provided for dredging at the entrance to the harbor to a depth of 12 feet at mean low tide; to dredging a channel on each side of the harbor and approaches to the same to a depth of 10 feet; to dredging small channels along the wharves at the extreme upper end of the harbor to 5 feet, and, after completion of the above, to dredging the Middle Ground of the harbor to the same depths as the adjacent channels. The project was completed in 1897 with an expenditure of $44,940.79.

The total expenditures to June 30, 1902, were $74,940.79.

There is one small stream emptying into the harbor at the extreme upper end, but it is not a silt-bearing stream, and it is believed that the improved depths have remained practically permanent.

Under the provisions of the river and harbor act of March 3, 1899,

a new survey was made in the vicinity of the Boston and Bangor Steamboat Company's wharf in the outer harbor and a project submitted for increasing the depths in this vicinity to 14 feet at mean and 11 feet at extreme low water, so as to accommodate the boats of this line which have had difficulty in reaching their wharves at extreme low run of tides. The cost was estimated at $7,400. This project is published as House Doc. No. 263, Fifty-sixth Congress, first session, and reprinted at page 1111 of the Annual Report of the Chief of Engineers for 1900. The appropriation of $7,400 contained in the river and harbor act approved June 13, 1902, will be expended in completing this improvement.

July 1, 1901, balance unexpended	$59.21
Amount appropriated by river and harbor act approved June 13, 1902	7,400.00
July 1, 1902, balance unexpended	7,459.21

(See Appendix A 9.)

10. Rockland Harbor, Maine.—The wharves are located on the shores of three coves formed by two projecting points of land on the western side of the harbor, known as Crocketts Point and Atlantic Point. The general direction of the wharf frontage is north and south and the length of frontage is about 800 feet. The unimproved depths in front of the wharves deepened very slowly, so that all the wharves except those at the end of Crocketts Point and Atlantic Point extended only a short distance beyond the low-water contour, a high mean range in tide, which at this point is 9.6 feet, being relied upon to give access to moderate and light draft vessels at high tides. The entrance to the harbor from the east has a width of about 9,000 feet.

Before improvement the anchorage in front of the wharves, vessels lying at the wharves, and the wharves themselves were endangered by heavy seas during easterly gales.

The first improvement undertaken was to render it a safe harbor of refuge for coastwise shipping and incidentally also to protect the wharves as far as possible from heavy seas. To accomplish this a project was adopted in 1881 in which two breakwaters were contemplated, one extending south from Jamesons Point, the other a detached breakwater nearer to and opposite the principal wharves in the town, both to be raised in the first instance to the level of mean tide, but with the expectation that a further raising would be necessary as experience might dictate.

In 1886 this project was amended so as to raise the height of the breakwater at Jamesons Point to the level of mean high tide. In 1890 it was again amended so as to eliminate the detached breakwater and to provide for extending farther south than was first contemplated the breakwater at Jamesons Point.

By the act of June 3, 1896, Congress adopted a project for dredging the inner harbor in the vicinity of the wharves to depths ranging from 4 feet to 13 feet at mean low tide, and for removing two dangerous ledges, one occupying a central position in the harbor, which was to be cut down to the depth of 22 feet at mean low tide. The other, less centrally located, was to be removed to a depth of 14 feet. The estimated cost was $403,000. By the same act this project was combined with that for the breakwater as one project, and authority was given for completing the whole under the continuous-contract system at an estimated expenditure of $1,036,000.

The dredging was finished in May, 1901; the removal of ledge in the fall of 1901. The breakwater was also completed to the height and slopes contemplated before the close of the same season. The work for the past fiscal year under these contracts consisted in the removal of 3,620 cubic yards of ledge and in the placing of 11,757 tons of stone on the breakwater. The total quantities in the above project were: Material dredged from harbor, 487,567 cubic yards; ledge removed, 30,180 cubic yards; stone placed in breakwater, 37,888 tons.

The displacement of a number of the heavy stones between high and low water on the exposed side of the breakwater during the gales of the winter of 1900–1901 indicated the necessity of further strengthening of the sea slope of the breakwater by the addition of more heavy stones. A project for this additional work was approved and a contract entered into for doing the work. This contract was completed June 30, 1902. The amount of stone placed under this contract was 32,656 tons, making a total of 768,774 tons in the breakwater.

The total expenditures on the improvements in the harbor to June 30, 1902, were $880,093.41.

The benefits resulting from these improvements are considerable. The breakwater has afforded a safe and extensive anchorage and harbor of refuge. The excavation of ledges has increased the available anchorage area and has removed dangerous obstructions to boats in motion, and the dredging will afford access to the wharves by vessels of greater draft when the wharves are built out to the harbor line.

In dredging in the upper portion of the harbor near Crocketts Point several places of ledges were uncovered. The question is now being considered whether the needs of navigation will not be sufficiently improved by marking them by one of the usual aids to navigation, or whether their removal will be necessary. Should the latter course be decided upon, the balance of funds available under previous appropriations will be sufficient to do the work.

The commerce for the last eight years is given as follows:

	Tons.		Tons.
1894	509,853	1898	579,300
1895	615,830	1899	755,649
1896	580,295	1900	553,000
1897	594,992	1901	522,175

July 1, 1901, balance unexpended	$162,604.59
June 30, 1902, amount expended during fiscal year	117,198.00
July 1, 1902, balance unexpended	45,406.59
July 1, 1902, outstanding liabilities	9,224.68
July 1, 1902, balance available	36,181.91

(See Appendix A 10.)

11. Carvers Harbor, Vinalhaven, Me.—The object of the improvement is to secure a better anchorage than the harbor afforded in its natural state. Before improvement the anchorage area was limited as to area and depth, there being less than 8 feet at mean low tide over the most of it.

The project of improvement, as approved by the Secretary of War May 11, 1897, provides for dredging the inner harbor to a depth of 16 feet at mean low tide over an area about 23 acres in extent and at an estimated cost of $64,000.

The expenditures to June 30, 1902, were $24,211.69. With this

sum about 14 acres of the proposed area of 23 acres to be dredged had been completed and about 50 per cent of the total estimated amount of material had been removed.

Toward the close of the last contract two points of ledge, projecting about 3 feet above the plane of dredging, were uncovered, suggesting the probability that other and higher ledges might crop out as the work is carried farther up into the harbor. To ascertain if such is the case, a careful sounding with an iron rod will be made over the unfinished work before beginning work under a new appropriation with a view of modifying the limiting lines of the proposed anchorage area so as to include within them only such ground as can be dredged to the full depth of 16 feet.

No operations beyond inspection have been carried on during the fiscal year. It is proposed to expend the appropriation of $20,000 contained in the act of June 13, 1902, in continuing the dredging as far up the harbor as the funds will allow.

The improvement will be fairly permanent and will be a benefit to navigation in affording a harbor of refuge and increased facilities for reaching the wharf.

The mean range in tides is 9.3 feet.

The commerce for the last six years is given as follows:

	Tons.		Tons.
1896	63,078	1899	63,390
1897	63,074	1900	64,500
1898	60,000	1901	78,300

July 1, 1901, balance unexpended	$788.86
Amount appropriated by river and harbor act approved June 13, 1902	20,000.00
	20,788.86
June 30, 1902, amount expended during fiscal year	.55
July 1, 1902, balance unexpended	20,788.31
July 1, 1902, outstanding liabilities	150.00
July 1, 1902, balance available	20,638.31

(See Appendix A 11.)

12. Georges River, Maine.—This river is a tidal estuary with a mean rise and fall of the tide of 10 feet. The head of navigation is Thomaston, Me.

The navigable depth is full 3½ fathoms to a point about 1 mile from Thomaston, but from this point to the head of navigation the channel before improvement was narrow, with a short bend at one point, and with a least depth of about 11 feet at mean low tide.

By act of June 3, 1896, Congress adopted a project for dredging to 16 feet at mean low tide, and to widths as follows: As far up as the bend, 160 feet; in the bend, 220 feet; beyond the bend, 125 feet, narrowing to 90 feet at the upper end.

The expenditures to June 30, 1902, were $19,787.94, at which date a channel had been dredged to full projected width and depth except at the extreme upper end, where there remains to be excavated a section of the channel 900 feet long by 90 feet wide to complete the improvement. This work will be completed by an appropriation of $6,000 in the river and harbor act approved June 13, 1902.

Gradual shoaling of the proposed channel by material brought down by freshets may be expected, but the process will be slow and a depth

sufficient to accommodate the traffic will probably be maintained for a number of years.

The depth of the dredged channel is such that the vessels using it could be towed out at any stage of the tide, but, as the business does not seem to warrant the maintenance of a tug boat, they have to wait until near high water and a favorable wind in order to go out or in under sail with safety.

The commerce for the last six years is given as follows:

	Tons.		Tons.
1896	45,375	1899	60,000
1897	64,250	1900	29,225
1898	59,000	1901	60,000

July 1, 1901, balance unexpended	$212.62
Amount appropriated by river and harbor act approved June 13, 1902	6,000.00
	6,212.62
June 30, 1902, amount expended during fiscal year	.56
July 1, 1902, balance unexpended	6,212.06
July 1, 1902, outstanding liabilities	100.00
July 1, 1902, balance available	6,112.06

(See Appendix A 12.)

13. Kennebec River, Maine.—Before improvement the main channel of the river between the foot of Swan Island and Gardiner was obstructed by shoals near Beef Rock, with only 10 feet of water at mean low tide, by dangerous sunken ledges in Lovejoy Narrows, by a shoal below South Gardiner with only 8 feet on it at mean low tide, and by a ledge at Nehumkeg Island. The steamboat channel to the west of Swan Island (at Hatchs Rock) was obstructed by a shoal over which there was only 7½ feet of water, and the channel between Gardiner and Augusta, a distance of 6½ miles, was obstructed by shoals which gave a navigable depth of only 3½ feet in low summer tides.

Appropriations for minor improvements were made at various times between 1827 and 1852.

In 1866 a project was begun for improving the upper part of the river with a view to obtaining a channel 7 feet deep and 100 feet wide at low water. This project, with modifications, was completed in 1877 and resulted in obtaining a channel 10 feet deep at mean low tide and not less than 100 feet wide in its lowest summer stages as far up as Gardiner, and a depth of 6½ feet at low tide and width of 100 feet from Gardiner to Augusta.

The channel west of Swan Island, being obstructed by shoal water (8½ feet at mean low tide) and a too narrow channel at the head of the island, by shoal water at Hatchs Rock, below Richmond, and by a very narrow channel 30 feet wide at the foot of the island, was improved by dredging in 1881–1883, so as to give a channel 175 feet wide and 11 feet deep at the foot of the island and a channel of about 80 feet wide and 10 feet depth at Hatchs Rock and the head of the island.

The river and harbor act of 1886 provided for a new survey of the river from Bath to Augusta. This survey was made in 1887, and a project embracing dredging, rock excavation, and contraction works was submitted for the further improvement of the river. In 1892 this

project was revised to secure depths as follows: thirteen feet at mean low tide as far up as Sands Island; 12 feet thence to Hinckleys Shoal, above Gardiner; and 10 feet thence to Augusta, at an estimated cost of $388,500. This project was approved August 19, 1892, and was completed in 1898.

The total expenditures upon the river to June 30, 1902, upon the projects above enumerated were $473,273.47.

The improved channel obtained under the above projects has suffered some loss of available depth by the deposits brought down by freshets. This shoaling has been most marked in the stretch of 6½ miles of river between Gardiner and Augusta, the further improvement of which is provided for by the river and harbor act approved June 13, 1902, which appropriated $40,000 and authorized a continuous contract for the completion of the project. The last project is published in House Doc. No. 262, Fifty-sixth Congress, first session, and at page 1121 of the Annual Report of the Chief of Engineers for 1900, and proposes a widening of the channel from Gardiner to Augusta to 125 feet and a cleaning out of the old dredged channel and its further deepening to 16 feet at mean high water, or 11 feet at mean low water.

The spring freshet of 1902 was of more than average height and duration, and caused injurious shoaling in the main channel on the east of Swan Island, at Beef Rock Shoal, and in the west channel at the head of the island, at Hatchs Rock, but more particularly abreast of Theobalds Point, near the foot of the island. The shoaling at Beef Rock was 3 feet, giving 11 feet at mean low tide, where a depth of 14 feet had been maintained since the dredging of 1892, and that at Theobalds Point, where the depths had heretofore always been ample, had reduced the available depth of water to about 8 feet at mean low tide. A deepening of the channel at both points being very urgent, a dredge was hired to dredge these shoals at a cost of about $5,000. This dredging is in progress. Surveys have also been made of the other two worst shoals in the west channel with a view to preparing projects for redredging.

The mean rise and fall of tides at Bath is 6.9 feet; Gardiner, 5.1 feet; Augusta, 4.3 feet.

The commerce for the last eight years is given as follows:

	Tons.		Tons.
1893	970,938	1898	1,211,808
1894	1,207,965	1899	714,199
1895	1,162,972	1900	716,930
1897	665,991	1901	542,626

Variations in the tonnage of this stream are due principally to variations in the quantities of ice moved from year to year.

GENERAL IMPROVEMENT.

July 1, 1901, balance unexpended	$27,634.65
June 30, 1902, amount expended during fiscal year	558.12
July 1, 1902, balance unexpended	27,076.53
July 1, 1902, outstanding liabilities	1,997.10
July 1, 1902, balance available	25,079.43

BETWEEN GARDINER AND AUGUSTA.

Amount appropriated by river and harbor act approved June 13, 1902	$40,000.00
July 1, 1902, balance unexpended	40,000.00
Amount (estimated) required for completion of existing project	41,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	41.000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix A 13.)

14. Portland Harbor, Maine.—The entrance to the main part of the harbor of Portland, or the anchorage, has always been good, but before improvement the approach to the inner harbor was obstructed by a shoal known as the Middle Ground, over which the depth was only from 8 to 10 feet at mean low tide, while between it and Stamford ledge the greatest available depth was only 16 feet. The best part of the wharf front was exposed to swell from the main entrance, which sometimes made it dangerous for vessels to lie at the docks, and along this front the depth was in some places as shallow as 4 feet.

The first work of improvement undertaken by the Government was the construction of the breakwater. This was begun as early as 1836. It was completed in 1874.

The work of deepening the harbor was begun under the act of Congress of 1868, the plan of improvement being to excavate a channel 300 feet wide and 20 feet deep at mean low tide through the southern slope of the Middle Ground, and to remove the bar off the Grand Trunk Railroad wharves to the same depth.

The project was modified in 1870 so as to provide for a channel 400 feet wide, and again in 1871 so as to provide for a channel 500 feet wide. In 1872 further modifications were made by including in the project the dredging of Back Cove and the dredging of the inner harbor up to the harbor commissioner's lines to a depth of 16 feet at mean low tide. The project, modified as above described, excepting some dredging in the inner harbor, was completed by 1876.

Between 1881 and 1885 the Middle Ground was removed to a depth of 21 feet at mean low tide.

A further deepening of a portion of the harbor to 29 feet at mean low tide was next begun under the project of 1886. To this was subsequently added, in 1890, a small amount of dredging in the upper part of the harbor.

In 1894 the project was extended to cover the widening of the upper part of the 29-foot area and the dredging of a channel 25 feet deep to connect the deep water in the lower part of the harbor with deep water in the upper part. This work was completed in 1894.

By the act of June 3, 1896, Congress adopted a project for dredging to 30 feet at mean low tide over the greater part of the harbor at an estimated cost of $770,000, and included in the project the further improvement of Back Cove at a combined estimate of $946,250. The same act appropriated $20,000 for beginning work and authorized the making of a contract for its completion.

After twice advertising, a contract for the entire work was entered into. Dredging was begun July 2, 1897, and by the terms of contract was to be completed November 20, 1898. Progress from the first was slow and plant inadequate, and the contract was extended, under promise of better progress, to November 30, 1899. The contractors failed

financially April 19, 1899, lost their dredge by seizure for debt, and never afterwards resumed work. After their retirement other arrangements were made, by the open-market method, to continue the dredging during the unexpired portion of said contract. This period having expired, the unfinished work was advertised. Bids therefor were opened March 27, 1900, and all rejected as too high. The work was again advertised, bids opened June 30, 1900, and a new contract entered into.

The work of the past fiscal year under the last-mentioned contract consisted in the removal of 1,355,208 cubic yards of material, situ measurement, being the equivalent of 1,575,580 cubic yards scow measurement. The amount remaining to be dredged during the next fiscal year in completion of the project is about 500,000 cubic yards. The total amount dredged by the present contractors to June 30, 1902, is 2,177,108 cubic yards, situ measurement, and the total removed under the project is 3,990,517 cubic yards, situ measurement.

There are no silt streams emptying into Portland Harbor, and the improved depths obtained under the project will be practically permanent. The maximum draft that can be carried to the wharves in Portland Harbor is 30 feet, and the maximum draft which can be carried to the wharves in Back Cove is about 11 feet. The mean range in tide is 8.8 feet.

Two principal advantages have followed this large improvement. A large and well-sheltered deep-water anchorage has been created under the shelter of the breakwater, and the trans-Atlantic vessels can arrive and depart from their docks at the lowest stages of tide.

The total amount expended upon the harbor, including Back Cove, to June 30, 1902, is $1,186,170.97.

The commerce for the last eight years is given as follows:

	Tons.		Tons.
1894	1,214,887	1898	1,334,752
1895	1,339,064	1899	1,620,284
1896	1,357,575	1900	2,261,008
1897	1,326,844	1901	2,461,515

July 1, 1901, balance unexpended	$283,552.57
June 30, 1902, amount expended during fiscal year	185,996.49
July 1, 1902, balance unexpended	97,556.08
July 1, 1902, outstanding liabilities	29,344.95
July 1, 1902, balance available	68,211.13
July 1, 1902, amount covered by uncompleted contracts	61,904.47

(See Appendix A 14.)

IMPROVEMENT OF RIVERS AND HARBORS IN MAINE SOUTH OF PORTLAND HARBOR, IN VERMONT AND NEW HAMPSHIRE, IN MASSACHUSETTS NORTH OF LYNN HARBOR, AND IN NEW YORK ON LAKE CHAMPLAIN.

This district was in the charge of Capt. Harry Taylor, Corps of Engineers, having under his immediate orders Lieut. R. R. Raymond, Corps of Engineers, to November 2, 1902. Division Engineer, Col. Chas. R. Suter, Corps of Engineers.

1. Saco River, Maine.—The first work done on the Saco River was in 1827, when an appropriation was made for the erection of piers, placing beacons or buoys, and removing obstructions. Prior to this

the depth of water on the bar was only about 2 feet at mean low tide, while much of the river was deeper. The entrance was also dangerous in rough weather, and the numerous projecting rocks and ledges in the river proper, in connection with the swift currents, made its navigation dangerous.

In 1866 a plan was proposed for the improvement of the mouth of the river, and a project was adopted in 1867. The project was for the construction of a breakwater, the removal of sunken rocks, and the rebuilding of some of the most important piers, against which vessels might drift without damage. This project was completed in 1878, at a cost of $169,275.

A resurvey of the breakwater was made in 1883, and a new plan submitted for raising and repairing it and extending it out to Sharps Ledge.

The river and harbor act of 1884 directed a survey to be made of the river. This was done in 1885, and a plan submitted for the improvement of the river proper from its mouth to the head of navigation. In 1890 the two projects were combined, so that the one now in process of execution is for improving Saco River, including the breakwater and jetty, the estimated cost of completion of both river improvement and breakwater being placed at that time at $185,000.

The amount expended on the work of existing project up to June 30, 1902, is $172,258.37.

The work done under both the old and new projects has resulted in removing dangerous ledges, in constructing piers to prevent vessels from being swept on the rocks, in constructing a breakwater on the north side of the entrance, and a jetty on the south side of the entrance to contract the channel way with a view to obtaining a greater depth over the bar; also in deepening the channels in the upper portion of the river by dredging, and the construction of contraction works.

An examination made in 1900 showed that about 3½ feet at mean low water is the maximum draft that can be carried over the bar just outside the breakwater and jetty. The mean rise and fall of tide is 8.8 feet.

In order to maintain the desired depth the breakwater on the north side should be extended to Sharps Ledge, as contemplated by the plan of improvement submitted in 1883, so as to stop the influx of sand from that side. Some uncertainty exists whether Congress has adopted the plan of extending the breakwater to Sharps Ledge. The probable cost of such extension and some minor repairs is estimated by the officer in local charge to be $200,000. Possibly the full extension may not be required to secure and maintain the projected depth.

No operations have been in progress during the past fiscal year, and on June 30, 1902, the condition of the improvement was the same as on the date of the last annual report.

The commerce of the last nine years is given as follows:

	Tons.		Tons.
1893	59,765	1898	44,508
1894	47,350	1899	46,597
1895	62,129	1900	50,354
1896	46,956	1901	42,625
1897	42,214		

July 1, 1901, balance unexpended	$5,241.63
July 1, 1902, balance unexpended	5,241.63

(See Appendix B 1.)

2. Cape Porpoise Harbor, Maine.—The harbor at Cape Porpoise is situated about midway between Portland, Me., and Portsmouth, N. H. Originally the harbor had a depth of about 13 feet at mean low tide, but for a small area only, and the entrance was obstructed by a bar on which there was only about 10 feet of water at mean low tide. The anchorage was too small to accommodate the small vessels seeking that place for refuge, without regard to the commerce of the place.

By act of March 3, 1899, Congress adopted a project for securing a channel of entrance 200 feet wide and 16 feet deep at mean low tide and a channel and anchorage within the harbor about 3,000 feet long, 600 feet wide, and 15 feet deep at mean low tide, at an estimated cost of $125,000. By this act the improvement was placed under the continuous-contract system and $70,000 appropriated toward the work. The project is described in the Annual Report of the Chief of Engineers for 1899, page 1050.

The total expenditures on this work to June 30, 1902, were $72,500.

Contract for the dredging of this harbor was entered into and operations thereunder were commenced early in June, 1900, and completed in December of the same year. In the execution of the dredging a small area of ledge was uncovered in the northern part of the harbor, estimated to contain 370 cubic yards, on which there was about 8 feet depth at mean low water. This ledge was removed during the past fiscal year and the harbor is now completed in accordance with the general project.

The maximum draft that can be carried in the harbor is 15 feet at mean low water. The mean range of tides is about 8.8 feet.

It has been impracticable to obtain detailed commercial statistics, but the receipt of about 20,000 tons of coal annually has been reported for the last few years. The harbor is also used as a home port for a number of fishing vessels.

July 1, 1901, balance unexpended	$12,840.54
June 30, 1902, amount expended during fiscal year	5,340.54
July 1, 1902, balance unexpended	7,500.00

(See Appendix B 2.)

3. Harbor at Isles of Shoals, Maine.—A description of this harbor may be found in the Annual Report of the Chief of Engineers for 1900, Part II, page 1172, and is also published, together with a map of the harbor, as House Doc. No. 255, Fifty-sixth Congress, first session.

The principal island of the group known as "Isles of Shoals" is Star Island, on which is located the old village of Gosport. Gosport Harbor lies to the north of this island and is protected on its north and east by Smuttynose Island, and on the south and southeast by Star and Cedar islands, and on the east by what remains of a breakwater constructed by the United States in 1821–1823 between Smuttynose and Cedar islands, at a cost of $13,251.61. This breakwater has been beaten down and spread out by the sea, so that its crest now averages only about 1½ feet above mean low water and is of little or no protection to the harbor.

The river and harbor act of June 13, 1902, appropriated $30,000 for the completion of the improvement of this harbor in accordance with the report submitted in House Doc. No. 255, Fifty-sixth Congress, first session. The proposed improvement consists in the con-

struction of a breakwater on the site of the old one to a height of about 15 feet above mean low water, at a cost of $30,000.

The place is of considerable importance as a harbor of refuge for the numerous fishing boats and small vessels along the coast. The statistics of the amount of shipping directly interested can not be obtained, but would comprise all the great fleet of small vessels passing up and down the New England coast.

Amount appropriated by river and harbor act approved June 13, 1902... $30,000.00
July 1, 1902, balance unexpended 30,000.00

(See Appendix B 3.)

4. Cocheco River, New Hampshire.—Before the improvement was begun the river from Dover to the Lower Narrows was much obstructed by bowlders, ledges, and shoals, the depth being in some places as little as 6 inches at mean low tide. The tide rises and falls about 7 feet.

A project for improvement was adopted in 1871, which provided for a channel 40 feet wide and 4 feet deep from the Lower Narrows up to Collin's wharf. The estimated cost was $45,000. Subsequently, more accurate and extended surveys having shown the practicability and importance of extending the improvements up to the head of navigation, the project was extended and the estimate increased to $85,000. This project was completed in 1879. The improvements had opened up a large commerce, employing large vessels where formerly only flatboats had been used, in consequence of which the project was still further extended by providing for a "cut-off" through Alleys Point, widening to 60 feet and deepening to 5 feet the existing channels through Trickeys and Clements Point shoals, and blasting and removing other obstructions. The extended project was completed in 1888. The total amount expended on the original and modified projects to that time was $170,000. These expenditures resulted in giving a channel through the rocky bed of the river 5 feet deep and 40 feet wide in the narrowest parts, where the depth before was only from 6 inches to 2 feet.

In 1889 a new survey was made under the river and harbor act of 1888, and a new project was submitted for obtaining a depth of 7 feet, increased to 7½ feet in rock, with a width of 50 feet in rock and 60 to 75 feet where the material is less expensive to remove. This project was adopted in 1890, and is estimated to cost $175,000.

The total expenditures under the project of 1890, up to June 30, 1902, amount to $83,924.79. Under this project the upper end of the channel at Dover has been deepened to 7 feet at mean low tide for a length of 1,200 feet down river, with a width varying from 100 to 140 feet; from this point the channel is now 50 to 75 feet wide, 7 feet deep at mean low water (and 7½ feet in rock) for a further distance of 2,800 feet, making a total length of channel at the upper end of 4,000 feet completed to full proposed dimensions except over a small portion in the lower part, where, owing to ledge, the required depth was not made.

The available depth is but 5 feet at mean low tide.

The river and harbor act of June 13, 1902, appropriated for continuing this improvement $30,000, of which $10,000 may be expended on Lamprey River.

The commerce for the last nine years is given as follows:

	Tons.		Tons.
1893	66,933	1898	131,005
1894	68,415	1899	144,040
1895	83,151	1900	155,180
1896	59,755	1901	199,890
1897	(a)		

July 1, 1901, balance unexpended	$6,075.21
Amount appropriated by river and harbor act approved June 13, 1902	30,000.00
July 1, 1902, balance unexpended	36,075.21

(See Appendix B 4.)

5. Exeter River, New Hampshire.—A survey of this river was made in 1874 from its mouth in Great Bay up to the wharves at Exeter, a distance of 8.3 miles, and a project was submitted to obtain a towing channel with a minimum width of 40 feet and a minimum depth from the mouth to Oxbow (5.6 miles) of 12 feet at high tide and from Oxbow up to Exeter of 10 feet, and to remove the bowlders all the way up between the 10-foot contours down to a depth of 10 feet below high tide, at an estimated cost of $34,000. This improvement was completed in 1882 at a cost of $35,000.

Under the requirements of the river and harbor act of June 3, 1896, a new survey was made from the mouth of the river to the upper bridge at Exeter and a report (printed in the Annual Report of the Chief of Engineers for 1897, p. 818) submitted, containing a project for a towing channel 40 feet wide, 12 feet deep at mean high tide up to Oxbow, and 11 feet deep at mean high tide thence up to Exeter, the estimate of cost being $12,000. By the act of March 3, 1899, this project was adopted and the entire amount of the estimate appropriated.

Soon after operations had commenced under this appropriation it was found that considerable filling in had taken place since the last survey in 1896 and that the amount of the original estimate of $12,000 would be insufficient to complete the work. An additional estimate of $7,000 for the completion of the work is published on page 1040 of the Annual Report of the Chief of Engineers for 1901, and this amount was appropriated by the river and harbor act approved June 13, 1902.

The total expenditures to June 30, 1902, under the existing project amount to $11,903.03. The channel proposed by this project has been completed 40 feet wide and 11 feet deep at mean high water from Exeter down river as far as Swamscot Bar, opposite Newfields. The available depth up to the wharves at Exeter does not exceed 4 feet at mean low tide, or about 10 feet at mean high tide.

The commerce involved in this improvement consists principally of coal for local consumption, a total of about 10,000 tons being reported annually.

July 1, 1901, balance unexpended	$96.97
Amount appropriated by river and harbor act approved June 13, 1902	7,000.00
July 1, 1902, balance unexpended	7,096.97

(See Appendix B 5.)

6. Harbor of refuge at Little Harbor, New Hampshire.—A survey was made of Little Harbor in 1882, and a plan of improvement proposed for the opening of an entrance channel with a depth of 9 feet

(a) No statement could be obtained.

at low tide and a width of 100 feet, together with a basin 300 by 700 feet, which was to be protected by a rubblestone breakwater. The estimated cost was $33,000. This project was approved in 1886 and its execution entered upon. In 1887 the project was enlarged to provide for the construction of two breakwaters—one on the north, the other on the south side of the entrance to the harbor—and the dredging of an anchorage about 49 acres in extent in the protected area to a depth of 12 feet at mean low tide. The estimated cost of the enlarged project was $235,000, and the act of 1888 made an appropriation for the work on the enlarged plan.

In October, 1894, after the breakwaters had been completed and a part of the dredging accomplished, the project was amended by reducing the area of the anchorage to be dredged to about 40 acres instead of 49. At the same time the project was revised and the cost of the entire work placed at $145,000.

Before the improvement the depth in the harbor was only about 6 feet at low tide, and the anchorage was small and exposed.

The total expenditures up to June 30, 1902, amount to $131,704.18. Both breakwaters have been completed, and the anchorage has been dredged to full projected width, except a cut about 25 feet wide on the south side, and to full depth—12 feet.

The available depth at the present time is 12 feet at mean low tide over the greater part of the anchorage and the entrance and 9 feet over the part of the anchorage not yet dredged. The mean range of tide is about 8.5 feet.

The estimated amount required for the completion of this improvement is $13,000, which amount was appropriated by the act of June 13, 1902.

July 1, 1901, balance unexpended	$295.82
Amount appropriated by river and harbor act approved June 13, 1902	13,000.00
July 1, 1902, balance unexpended	13,295.82

(See Appendix B 6.)

7. *Newburyport Harbor, Massachusetts.*—Newburyport, Mass., is situated about 2½ miles from the Atlantic Ocean, on the south bank of Merrimac River. The river empties into the Atlantic Ocean midway between Cape Ann and Portsmouth, or about 30 miles a little east of north from Boston in a direct line.

The outlet of the river between Plum Island and Salisbury Point is 1,000 feet wide and 30 feet deep at mean low water. At a distance of nearly a mile outside lies a sandy bar, thrown up by wave action, through which, previous to the improvement, a channel, variable in position and depth, was maintained by the current of the river, increased by the tidal flow in a large interior basin through a mean range of tides of 7.7 feet. For 1,000 feet outward from the gorge toward the crest of the bar the current was able to maintain a channel of navigable width and 18 feet deep at mean low water, and for a further distance of 1,500 feet a channel 12 feet deep. From the 18-foot contour line on the inside to the same on the outside the distance was 4,000 feet, and between the 12-foot contours the distance was 3,000 feet. The depth over the crest of the bar was originally but about 7 feet, and the channel was narrow and shifting.

The object of the improvement is to create through the outer bar a channel 1,000 feet wide and at least 17 feet deep at mean low water, so that vessels may cross the bar and find a harbor at any stage of the tide

with as great draft as can reach Newburyport by the river at high tide. The project submitted September 16, 1880, proposed two converging rubblestone jetties, their outer ends 1,000 feet apart and to be extended parallel to the axis of the channel, if necessary, and the protection of the beach in their vicinity, at a cost, as estimated in 1881, of $365,000. The direction of jetties and shore protection was modified in 1883, and in 1882 the partial closing of Plum Island Basin with a timber dike about 800 feet long and 5½ feet above mean low water was added to the project, increasing the cost to $375,000, as estimated in 1884.

In 1884 a modification of project provided for extension of both jetties parallel to the axis of the channel for a distance of 610 feet, and in 1886 the length of extension was increased to 1,000 feet, increasing the cost of the work, as estimated in 1897, $224,547.49. (Annual Report of the Chief of Engineers for 1897, p. 825.)

Both jetties are 15 feet wide on top—which is in a plane 12 feet above mean low water—and have slopes of 1 on 2 on the sea side and 1 on 1 on the shore side.

A map showing the location of the jetties in published in the Annual Report of the Chief of Engineers for 1885, opposite page 494.

The total expenditures to June 30, 1902, amount to $335,554.37. The north jetty is completed for a total length of 2,705 feet and the south jetty for 2,050 feet. The Plum Island dike is 817 feet long, 5½ feet high above mean low water except near the middle, where a weir 150 feet long and 2 feet above mean low water was left temporarily. The sand catch in rear of the south jetty is in two branches, one 480 feet long and one 572 feet long.

No work was in progress during the past fiscal year other than the removal of North Rock, and with this exception the condition of the improvement is the same as on June 30, 1901.

The river and harbor act of June 13, 1902, appropriated $30,000 for the continuation of this improvement. It is proposed to apply these funds, together with a balance of $2,500 not required for the removal of North Rock, to such repairs to the jetties as may be necessary and to the extension of the south jetty as far as available funds will permit.

A survey made during June, 1901, shows that there has been some improvement in the depth on the bar, the controlling depth in 1901 being 12.6 feet at mean low water as against 11 feet at mean low water in 1899, when the last previous survey was made. The channel had moved slightly to the north of its 1899 position, but retained about the same width as it had at that time.

The commerce reported for this port for the last three years is as follows:

	Tons.
1899	180,600
1900	128,440
1901	183,000

July 1, 1901, balance unexpended	$3,459.71
Amount appropriated by river and harbor act approved June 13, 1902	30,000.00
	33,459.71
June 30, 1902, amount expended during fiscal year	514.08
July 1, 1902, balance unexpended	32,945.63
July 1, 1902, outstanding liabilities	160.00
July 1, 1902, balance available	32,785.63

(See Appendix B 7.)

8. Merrimac River, Massachusetts.—The mouth of the Merrimac River is 15 miles northwest from Cape Ann, Massachusetts. Tide water extends up it a distance of 21½ miles, or to the foot of the Upper Falls, 1½ miles above Haverhill, Mass.

Seven incorporated cities and the largest mills in New England are directly interested in this improvement.

Before improvement the channel was narrow and crooked and much obstructed by ledges, bowlders, and shoals. At mean low water vessels drawing not to exceed 7 feet could enter the river and proceed to South Amesbury, 9 miles from the mouth.

The mean rise and fall of the tide at the mouth is 7.7 feet; at Haverhill bridge, 4.6 feet at low-water stage of the river.

Since 1828 the channel of the river has been improved under a succession of projects, the principal one (dated 1870 and modified in 1874) providing for a channel with the following depths at ordinary high-water stages of the river: From the mouth to Deer Island bridge, 5 miles, 16½ feet; thence to Haverhill bridge, 12½ miles, 12 feet; thence to the foot of Mitchells Falls, Hazeltine Rapids, 1½ miles, 10 feet; thence through Mitchells Falls to the head of the Upper Falls, 2½ miles, not less than 4½ feet when the mill water at Lawrence is running. On June 30, 1894, the improvement of the river in accordance with these projects had been completed. Since that date the river has apparently shoaled to some extent in places.

The river and harbor act of June 3, 1896, appropriated $5,000 for the removal of "certain rocks below Rock Bridge," and in 1896–97 the channel at that point was cleared of obstructing bowlders, a total of about 1,060 cubic yards being removed.

The total cost of the work under the foregoing projects was $247,366.72.

The present approved project, submitted May 5, 1897, provides for a channel 7 feet deep at mean low water and 150 feet wide (ordinary low-water stage of the river) from Newburyport to Haverhill, at an estimated cost of $171,442.70. This project is published in the Annual Report of the Chief of Engineers for 1897, page 865.

The river and harbor act of March 3, 1899, appropriated $40,000 for the improvement of the river under the new project. Dredging was continued during the past fiscal year under this appropriation and at the close of the fiscal year the 150-foot channel had been completed to 7 feet depth at mean low water from a point near the head of Porter Island for a distance of about 7,000 feet down river, nearly through Curriers Shoal.

The total expenditures on the existing project up to June 30, 1902, amount to $29,117.29.

The river and harbor act approved June 13, 1902, appropriated $40,000 for this work, which it is proposed to apply to the extension of the improved channel down river, in accordance with the general project.

The maximum draft that can be carried, June 30, 1902, to the wharves at Haverhill at mean low water is 7 feet.

The commerce of the river is in coal, lumber, etc., for the cities and towns along its banks, the amount of coal reported in 1899 being 52,000 tons; in 1900, 60,000 tons, and in 1901, 60,000 tons.

July 1, 1901, balance unexpended	$38,570.58
Amount appropriated by river and harbor act approved June 13, 1902	40,000.00
	78,570.58
June 30, 1902, amount expended during fiscal year	27,687.87
July 1, 1902, balance unexpended	50,882.71
July 1, 1902, outstanding liabilities	7,830.06
July 1, 1902, balance available	43,052.65
July 1, 1902, amount covered by uncompleted contracts	2,970.00

(See Appendix B 8.)

9. Powow River, Massachusetts.—Powow River is a tributary of the Merrimac River, which it enters from the north about 3½ miles above Newburyport. From its mouth tide water extends 9,600 feet in a narrow, crooked channel, not navigable at low water.

The project proposed for its improvement is to dredge a channel 9,600 feet long, 60 feet wide, and 12 feet deep at mean high water, estimated in 1897 to cost $100,000. (Annual Report of the Chief of Engineers for 1897, p. 829.) The object of the improvement is to secure a navigable low-water channel to the wharves at Amesbury.

The expenditures to June 30, 1902, were $50,940.72. At that date the projected 9,600-foot channel was 12 feet deep at mean high water, 45 feet wide from Amesbury to the mouth of the river except for a distance of 650 feet at the lower end, where it was 30 feet wide.

The maximum draft that can be carried June 30, 1902, at mean low water to the wharves at Amesbury is 6 feet. The mean rise and fall of tide is 6.7 feet.

No operations were in progress during the past fiscal year, and the condition of the improvement is the same as on June 30, 1901.

The commerce of the river is in coal for local consumption, about 5,000 tons being reported annually.

July 1, 1901, balance unexpended	$59.28
July 1, 1902, balance unexpended	59.28

(See Appendix B 9.)

10. Harbor of refuge, Sandy Bay, Cape Ann, Massachusetts.—Sandy Bay is situated at the northeastern extremity of Cape Ann, Massachusetts. It is about 2¾ miles by 2 miles in area, and is fully protected on the west and south by high hills, but fronts the northeast, and is open to the full effects of easterly and northeasterly gales. The great seas of the ocean are broken, however, in a degree by the sunken rocky ledges called Averys Ledge, the Dry and Little Salvages, the Flat Ground, and Abners Ledge, which are directly at the mouth of the bay. Inside these entrance ledges the bay is entirely unobstructed and has an average depth of 50 feet at mean low water. The shore lines of Sandy Bay form a little less than a right angle, and their directions are nearly north and south and east and west. The rocky island of Straitsmouth forms the eastern extremity of one shore line and the steep headland of Andrews Point the northern end of the other.

The proposed improvement contemplates the construction of a national harbor of refuge of the first class. The anchorage covered by the breakwater will contain 1,377 acres, in which the depth exceeds 24 feet at mean low water.

The estimated cost of the improvement is $5,000,000. The original

project of 1884 proposed a continuous breakwater 9,000 feet long, divided into two branches. One branch starts at Averys Ledge and runs in a direction a little west of north to Abners Ledge, a distance of 3,600 feet; the other extends 5,420 feet from Abners Ledge in a northwesterly direction and terminates at the 84-foot contour off Andrews Point.

The axis of the proposed breakwater is approximately at the inner edge of the ledges at the entrance of the bay and about 1 mile inside the Salvages and Flat Ground, which receive the first shock of easterly storm waves.

The southern entrance to the proposed harbor lies between Straitsmouth Island and Averys Ledge, and is to be 1,800 feet wide and at least 30 feet deep. The northern entrance, near Andrews Point, is 2,700 feet wide and 80 feet deep. They are so located with reference to each other that vessels can enter and leave the harbor with any wind.

The substructure in the original project was to consist of a mound of rubblestone to a grade of 22 feet below mean low water, 40 feet wide on top, to be surmounted by a masonry wall.

On March 2, 1892, the project was modified in accordance with a report of a Board of Engineers. The project as modified proposes to construct the entire breakwater of rubblestone, with the following section: On the sea side, from the bottom to 15 feet below mean low water, a slope of 1 on 1½; thence to mean low water, 1 on 3; thence to 18 feet above mean low water, 1 on 1; the width on the crest, 20 feet, and the rear slope, 1 on 0.73, to mean low water; thence to the bottom, 1 on 1; the portion below low water to be built of stone of less than 4 tons weight, the upper portion of stone averaging 6 tons weight.

A plan of the bay, showing the proposed breakwater, is published in the Annual Report of the Chief of Engineers for 1892, page 564.

The report of the Board of Engineers, which the Secretary of War was required to appoint by the act of March 3, 1899, to examine and report upon the project for this work, is published in House Doc. No. 453, Fifty-sixth Congress, first session, and may also be found on page 1184 of the Annual Report of the Chief of Engineers for 1900.

The total expenditures to June 30, 1902, were $1,072,496.83. At that date 1,423,417 tons of rubblestone had been placed in the breakwater, 113,202 tons of which was deposited during the past fiscal year, and its condition was approximately as follows:

The substructure of the southern arm was completed to mean low water, except for a distance of 70 feet, over which nothing had been done.

The substructure of the western arm is completed for a distance of 400 feet to elevation (—12). This 400-foot section is surmounted by a core of the superstructure 12 feet wide on top, built up to mean high water. For a further distance of about 1,700 feet the substructure is built to from 22 to 25 feet below mean low water, about 40 feet wide on top.

The exact condition of the breakwater on June 30, 1902, is shown on plan published in Appendix B of this report.

The river and harbor act approved June 13, 1902, appropriated $200,000 for the continuation of this improvement and provided for the appointment of a Board of Engineers to examine into and report upon the project.

The prospective benefits to commerce and navigation by the construction of this harbor of refuge are increased safety to life and property and a consequent reduction in freight and insurance.

July 1, 1901, balance unexpended	$158,205.34
Amount appropriated by river and harbor act approved June 13, 1902	200,000.00
	358,205.34
June 30, 1902, amount expended during fiscal year	80,702.17
July 1, 1902, balance unexpended	277,503.17
July 1, 1902, outstanding liabilities	15,705.59
July 1, 1902, balance available	261,797.58
July 1, 1902, amount covered by uncompleted contracts	55,286.39

(See Appendix B 10.)

11. Harbor at Rockport, Mass.—Rockport, Mass., is situated about 37 miles northeast of Boston, Mass., upon the northeastern shore of the rocky promontory of Cape Ann, which forms the northern limit of Massachusetts Bay. The town extends along both shores of Sandy Bay, which is open to the full sweep of storms from north around to east.

The shores of Sandy Bay are rock bound, and in their natural state furnish no sheltered anchorage, making it necessary to construct artificial harbors to provide shelter for vessels engaged in the commerce of this port. Piers for this purpose were constructed at Rockport by private enterprise in 1811 to 1817, and breakwaters were built at this point by the United States in 1836 to 1847, at a cost of $69,082.57. The harbor is a natural cove, with its area somewhat enlarged by the projection of the main breakwater into the bay, and includes an area of about 15 acres. The main breakwater extends from Bear Skin Neck in an easterly direction. It is about 900 feet long, of which about 375 feet at the shore end is in good condition. The outer end of this portion is 71 feet wide and about 22 feet above mean low water. The outer portion of the breakwater, about 525 feet in length, has been badly damaged by the sea, and no traces remain of any regularity of form of construction. It consists of an irregular mound of rubblestone, about 125 feet wide between low-water lines. At extreme high tides about 400 feet of it is submerged, and in easterly storms the sea sweeps over it throughout its length.

A small breakwater extends northward from Norwoods Head about 200 feet, leaving an entrance channel 22 feet wide between the low-water lines of the two breakwaters. The smaller breakwater has been almost totally destroyed by the sea, and in its present condition consists of an irregular pile of rubblestone, spread over an area about 200 feet square. At the shore end a section of sea wall about 100 feet long still stands, with its crest about 25.4 feet above mean low water.

An examination and survey of the piers and breakwaters at Rockport was made in 1900, and the report thereon, which contains a detailed description and a map of the harbor, is printed as House Doc. No. 363, Fifty-sixth Congress, first session, and is also published in the Annual Report of the Chief of Engineers for 1900, page 1177.

The river and harbor act of June 13, 1902, appropriated $22,000 for completion of the improvement of the breakwaters and piers in accordance with the report submitted in House Doc. No. 363, above referred to. The proposed improvement consists in rebuilding the

breakwaters to a height of about 10 feet above high water with heavy rubblestone and in the removal of the principal rocks in the harbor, at an estimated cost of $22,481.80.

The commerce of this harbor is in supplies of coal, etc., for local consumption, in fish, and in large shipments of granite from the numerous quarries situated on the shores of Sandy Bay. An approximate estimate of the annual value of this commerce is $820,000.

Amount appropriated by river and harbor act approved June 13, 1902 .. $22,000.00
July 1, 1902, balance unexpended 22,000.00

(See Appendix B 11.)

12. Harbor at Gloucester, Mass.—Gloucester Harbor, an important center for the fishing fleet of New England, is about 20 miles north of Boston. Its inner harbor was originally obstructed by sunken rocks and shoals, and the approaches to the wharves were shallow, varying from 1 to 12 feet. The outer harbor was open to all southerly gales.

In 1871 a project was adopted for the removal of certain bowlders from the inner harbor and the construction of a breakwater from Eastern Point over Dog Bar to Round Rock Shoal. The only work done under this project was the removal of bowlders at a cost of $10,000, appropriated by the act of June 10, 1872. This work was completed in 1873 with the following results:

Clam Rock, removed from a depth of 1 foot to that of 9½ feet below the plane of mean low water, the level of the surrounding bottom. Pinnacle Rocks removed from 8½ feet above down to the level of the surrounding bottom, which has a depth of 16½ feet below the plane of mean low water. Rocks off J. Friend's wharf removed down to the level of the surrounding bottom. Rock off Pew's wharf was entirely removed to a depth of 5 feet below mean low water, and the largest bowlders were removed from the rocky shoal known as Babsons Ledge.

In 1884 a project was adopted providing for two breakwaters at the entrance of Gloucester Harbor, one to cost $752,000, on essentially the same site as that proposed in 1871, and a supplementary one through Normans Woe Rock, to cost $607,000.

In the annual report for this harbor for 1887 a general project for its improvement was submitted, based on the survey provided for by the act approved August 5, 1886. This project proposed to remove from the inner harbor 101½ cubic yards of rock known to exist, and to dredge 216,000 cubic yards, scow measurement, at an estimated cost of $65,000, and to construct the breakwater recommended in the project of 1884 that extends from Eastern Point to Round Rock Shoal, at an estimated cost of $752,000.

On May 5, 1897, a project was submitted for the removal of a Pinnacle rock in the outer harbor to a least depth of 16 feet below mean low water, and rocks off the ferry landing at Rocky Neck to a level of the surrounding bottom, the work having been authorized by the river and harbor act of June 3, 1896.

On December 18, 1897, a revised project for the construction of the breakwater was submitted. This project proposed to build the substructure of the breakwater of rubblestone up to mean low water and 31 feet wide at that grade, to be surmounted by a superstructure formed of two dry walls of heavy split stone laid with the greatest dimension at right angles to the axis of the breakwater, the interior space to be filled with rubblestone and to be capped by heavy stone,

forming a top course 10 feet in width. The project was estimated to cost $698,083.43, and was approved January 4, 1898.

The total expenditures under the existing project and its modifications to June 30, 1902, were $180,871.80, and the following work had been accomplished in addition to the removal of the rocks reported above.

Babsons Ledge had been reduced from 11 to 14 feet, mean low water, and a Pinnacle rock in the outer harbor had also been removed to a depth of 16 feet below mean low water; and rocks off Ferry Landing at Rocky Neck had been reduced to the level of the surrounding bottom.

All the proposed dredging and rock removal had been done, the cost being about $15,000 more than the original estimate ($65,000), and the construction of the breakwater from Eastern Point to Round Rock Shoal was in progress; 106,686 tons of rubblestone had been deposited in the breakwater, completing about 1,650 feet of the substructure to the cross section proposed in the modified project of 1898, and about 284 linear feet of superstructure had been completed, beginning at Eastern Point.

No operations were in progress during the past fiscal year, and the present condition of the improvement is the same as on June 30, 1901.

The river and harbor act approved June 13, 1902, appropriated $75,000 for continuing the improvement of Gloucester Harbor and placed the improvement under the continuous-contract system, limiting the total cost to $227,083 in addition to the $75,000 appropriated by said act.

The act further provides—

> That the existing project may be modified so that the breakwater now under construction shall terminate at or near a ledge known as Cat Ledge, about two thousand two hundred and fifty feet from the shore, and the remainder of this appropriation and of the amount herein authorized not required for construction of said breakwater shall be applied toward the work of removing Round Rock, in said harbor.

The work in its present stage has greatly benefited the fishing industry, and its completion will furnish much-needed sheltered anchorage in this important harbor.

A line of passenger and freight steamers is operated continuously throughout the year, and other commerce exists in the form of imports of salt, coal, lumber, etc. The estimated value of this commerce is $5,000,000 annually.

The following gross tonnage of shipments and receipts is reported for the past five years:

	Tons.		Tons.
1897	82,600	1900	267,475
1898	86,050	1901	263,684
1899	287,922		

July 1, 1901, balance unexpended	$3,128.20
Amount appropriated by river and harbor act approved June 13, 1902	75,000.00
July 1, 1902, balance unexpended	78,128.20
Amount (estimated) required for completion of existing project	509,083.43
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	200,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix B 12.)

13. Harbor at Manchester, Mass.—Manchester Harbor is situated about 5½ miles northeast from the entrance of Salem Harbor, Massachusetts. The channel was 100 feet wide and 6½ feet deep at mean low water up to Proctors Point. It then shoaled rapidly to a depth of 1½ feet at the Narrows, 1,400 feet from Proctors Point, and for a further distance of 2,500 feet to the town wharves no low-water channel existed.

The original project, that of 1887, proposed to dredge a channel 60 feet wide, 4,000 feet long, and 4 feet deep at mean low water from Proctors Point to the town wharves. This project was completed in April, 1894, at a cost of $14,300, giving a channel of full projected width and depth, with an additional width of 80 feet opposite the town wharf.

A chart of the harbor is published in the Annual Report of the Chief of Engineers for 1888, page 466.

The present approved project of improvement was adopted March 3, 1899, and is printed in the annual report for 1897, page 869. It proposes to dredge the natural channel to a least width of 75 feet, and two turning basins, one just below the railroad bridge and one at the town landing, all 6 feet deep at mean low water, at an estimated cost of $25,000.

The amount expended on existing project to June 30, 1902, is $4,747.78. The project of 1887 has been completed, and under the project adopted in 1899 the channel has been completed from the 6-foot contour in the bay up to a point northwest of Proctors Point, a distance of 3,200 feet, except over two small ledges which project into the channel about 20 feet on the eastern side, about west of Proctors Point.

No operations have been in progress during the past fiscal year.

The available depth at mean low water that can be carried up to the town wharves is 4 feet.

The river and harbor act of June 13, 1902, appropriated $5,000 for continuation of this improvement.

The commerce involved in this improvement consists of supplies of coal, lumber, etc., for local consumption, about 10,000 tons being reported received in 1899, 12,000 in 1900, and 5,800 in 1901.

July 1, 1901, balance unexpended	$252.22
Amount appropriated by river and harbor act approved June 13, 1902	5,000.00
July 1, 1902, balance unexpended	5,252.22

(See Appendix B 13.)

14. Harbor at Beverly, Mass.—Beverly Harbor is a small harbor at the western end of Salem Bay and immediately adjacent to Salem Harbor on the south, from which it is separated by Salem Neck. It is formed by the confluence of the three branches of a tidal inlet, called respectively North River, Essex Branch, and Beverly Creek.

A full description of the harbor may be found in the Annual Report of the Chief of Engineers for 1890, Part I, page 524, and is also published, with map, in House Ex. Doc. No. 27, Fifty-first Congress, first session.

The river and harbor act of June 13, 1902, appropriated $10,000 for completing this improvement in accordance with the report submitted in House Doc. No. 129, Fifty-sixth Congress, second session (see Annual Report of the Chief of Engineers for 1901, p. 1065). It appears that this is the first appropriation made for the improvement of this harbor.

From a survey made in September, 1900, it was found that the harbor has an available channel of 18 feet depth at mean low water to the wharves of the town, but that this channel is so narrow at certain points as to make it difficult to take heavy vessels through without touching on one side or the other.

The proposed improvement consists in widening the present channel at certain points so as to give a clear channel width of about 200 feet, at an estimated cost of $10,000.

It has been impracticable to obtain reliable commercial statistics prior to 1901, when a total of 47,378 tons was reported.

Amount appropriated by river and harbor act approved June 13, 1902 ..	$10,000.00
July 1, 1902, balance unexpended	10,000.00

(See Appendix B 14.)

15. Repair of sea wall at Marblehead, Mass.—Marblehead, Mass., is about 12 miles north of Boston, Mass. A part of the town is situated on Marblehead Neck, a peninsula lying east of the mainland and connected therewith by an isthmus about 2,000 feet long and a least width of 105 feet between high-water lines, which forms the southern bound of Marblehead Harbor.

This isthmus is traversed by a highway, which is protected for about 1,900 feet of its length by a sea wall of light construction, reported to have been built by the United States Government in the early part of the present century.

A survey of the isthmus was made in September, 1896, and a report and plan of this survey were submitted to the Department on February 4, 1897, and are published in House Doc. No. 289, Fifty-fourth Congress, second session; also in the Annual Report of the Chief of Engineers for 1897, page 870.

The river and harbor act of March 3, 1899, appropriated $1,000 for the repair of the sea wall at Marblehead, made necessary by the great storm of November, 1898.

An examination of the sea wall was made in November, 1899, at a cost of $8.33. The wall seems to have served its purpose since its construction without sustaining any damage worth mentioning, and there was apparently no need of any repairs at the time of the examination.

The river and harbor act of June 13, 1902, directed a survey and estimate of cost to be made of a breakwater upon the southerly side of the causeway leading from Marblehead to Marblehead Neck, with a view to protecting the causeway from destruction or injury by the sea. This survey will be made and a report submitted during the coming autumn.

July 1, 1901, balance unexpended.....	$991.67
July 1, 1902, balance unexpended.....	991.67

(See Appendix B 15.)

16. Harbor at Burlington, Vt.—This harbor is situated on the eastern shore of Lake Champlain. In its natural condition ample depth of water existed along its docks and wharves, which were, however, unprotected from the severe storms crossing the lake. The greatest exposure is from the prevalent northwesterly gales, which have a sweep of 15 miles obliquely across the lake.

The original project for improvement, adopted in 1836, provided for the forming of an artificial harbor in front of the city by constructing a breakwater parallel with the shore and about 1,000 feet distant

from the docks and wharves. Work commenced in 1836 and continued at intervals until 1857, when 1,069 linear feet of breakwater had been completed.

In 1867 a Board of Engineers, convened to consider the location and construction of breakwater, recommended that the one previously constructed be extended northward 1,500 feet. Of this extension 831 linear feet was built, and, in addition, 617 linear feet was added at the south end, making its total length 2,517 feet at the close of the fiscal year 1874.

In June, 1874, a plan was adopted for an extension northward of the breakwater for a further distance of 2,000 feet, the cost being estimated at $340,000. (See Annual Report of the Chief of Engineers for 1874, p. 275.)

In 1884 extensive repairs were begun to the portion of the breakwater built between 1836 and 1857. By June 30, 1886, 3,560 linear feet of breakwater had been completed.

On September 28, 1886, a project was approved extending the breakwater 500 feet northerly and 1,000 feet southerly, keeping the line generally at a distance of from 800 to 1,000 feet from the line of the wharves, at an estimated cost of $150,000, and on August 24, 1894, the project was again amended so as to provide for replacing 3,800 linear feet of the decayed and dilapidated wooden superstructure of the breakwater with one of stone or concrete, at an estimated cost of $173,750.

Further description and history of the work may be found in the Annual Report of the Chief of Engineers for 1897, Part IV, page 3296.

The amount expended on original and modified projects prior to operations under existing project was $501,811.07.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1902, was $113,412.06.

At the time of the adoption of the project of 1886, a breakwater 3,560 feet long had been built. From 1886 to June 30, 1902, 1,670 linear feet of wooden superstructure on old sections of the breakwater had been replaced by superstructure of stone or concrete, and 600 linear feet of new breakwater, varying in width from 24 to 36 feet, had been built, making the total length of the breakwater 4,160 feet. This superstructure affords protection to nearly all the docks and wharves along the harbor front. During the past fiscal year operations were continued on the replacement of the decayed timber superstructure with one of concrete, about 237 feet being thus replaced during the fiscal year. In addition to this a section of the stone superstructure was repaired with a facing of large concrete blocks for a distance of about 180 feet.

The maximum draft that can be carried to the docks and wharves on June 30, 1902, is 11 feet at mean low water.

The river and harbor act of June 13, 1902, appropriated $57,750 for the repair and maintenance of this breakwater.

The principal items of commerce at this port are coal lumber, stone, and general merchandise, the following tonnage being reported for the past five years:

	Tons.		Tons.
1897	109,180	1900	131,226
1898	116,527	1901	108,234
1899	87,630		

July 1, 1901, balance unexpended		$13,487.70
Amount appropriated by river and harbor act approved June 13, 1902		57,750.00
		71,237.70
June 30, 1902, amount expended during fiscal year		13,149.76
July 1, 1902, balance unexpended		58,087.94

(See Appendix B 16.)

17. Otter Creek, Vermont.—This creek flows into Lake Champlain from its eastern shore. In its natural condition the channel was narrow and tortuous in places, and the available depth from Vergennes to the mouth—a distance of 8 miles—was less than 6 feet.

The original project, adopted in 1872, proposed the formation of a channel 100 feet wide and 8 feet deep from Lake Champlain to Vergennes, and also of a basin at this latter point, at an estimated cost of $58,146. (See Annual Report of the Chief of Engineers for 1872, p. 273.)

In 1882 the project was modified to provide for the removal of rock at the steamboat landing near Vergennes, which increased the cost to $73,748.40. (See Annual Report of the Chief of Engineers for 1882, p. 711.)

In addition, an annual expenditure estimated at $1,000 will be required for maintenance after completion of the work.

A detailed statement of the work done prior to June 30, 1897, may be found in the Annual Report of the Chief of Engineers for 1897, page 3299.

The amount expended to June 30, 1902, was $62,500. The condition of the channel at that date was such as to allow boats drawing 8 feet of water to navigate between Lake Champlain and Vergennes during the entire season.

No work was done during the last fiscal year.

The maximum draft that could be carried to Vergennes on June 30, 1902, was 8 feet at mean low water.

The commerce of this creek consists of coal, lumber, iron, kaolin, and general merchandise, the amounts reported in recent years being as follows:

	Tons.		Tons.
1896	9,052	1900	8,090
1897	7,680	1901	5,760
1899	7,200		

(See Appendix B 17.)

18. Harbor at Plattsburg, N. Y.—The original project for the improvement of this harbor was probably adopted in 1836, the date of the first appropriation, and proposed the construction of a breakwater about 1,000 feet east of the steamboat wharves. Between 1836 and 1875 a total of about 1,250 linear feet of breakwater was constructed.

A modification of the project made in 1870 provided for the extension of the former structure southeastward, the dredging of some shoal areas within the breakwater, and the protection of a portion of the adjacent beach by revetment.

After the completion of the project of 1870 the operations were confined to necessary repairs and the dredging of limited areas near the steamboat docks.

The act of September 19, 1890, appropriated $32,500 for completion of the improvement, and made provision for a northward extension to

the breakwater of 300 feet and for replacing by a stone parapet the crib superstructure of the older part. Under this appropriation the project was completed in January, 1893, since which time no work on this improvement has been done. The breakwater as completed is 1,850 feet in length. Some dredging has been done in the anchorage, and a short length of beach has been protected.

The total cost of the work to June 30, 1902, is $185,440.76.

The river and harbor act of June 13, 1902, appropriated $5,000 for the improvement of this harbor, for maintenance and restoration.

No commercial statistics for this harbor have been obtained since 1895, when a total of 46,395 tons was reported.

Amount appropriated by river and harbor act approved June 13, 1902	$5,000.00
July 1, 1902, balance unexpended	5,000.00

(See Appendix B 18.)

19. Narrows of Lake Champlain, New York and Vermont.—In its original condition the 15 miles of this waterway, extending from the northern terminus of Champlain Canal, at Whitehall, northerly to Bensons Landing, Vermont, had a very narrow and tortuous channel, not more than 9½ to 10 feet deep on the shoals at low water.

The original project, adopted in 1886, was to obtain a channel having a least width of 150 feet and depth of 12 feet at low water from the northern terminus of the Champlain Canal, at Whitehall, N. Y., to deep water in Lake Champlain, below Bensons Landing, Vermont, a distance of 15 miles, at an estimated cost of $80,000. (See Annual Report of the Chief of Engineers for 1885, pp. 2312–2314.)

Work under this project was completed in September, 1889, at a little more than half its estimated cost, owing to the low prices paid for dredging.

In 1890 a supplemental project was prepared for widening and straightening the middle reaches of the channel, at an estimated cost of $21,000. (See Annual Report of the Chief of Engineers for 1890, p. 2884.) This project was adopted in 1892 and work completed under it in August, 1896.

In 1896 a project was prepared for restoring, widening, and deepening the channel, at an estimated cost of $22,500, the cost of maintenance, after completion, being placed at $2,500 annually. (See Annual Report of the Chief of Engineers for 1897, pp. 3302–3303.) This project was adopted in 1899.

The amount expended on the original project and its modifications, as given above, to June 30, 1902, was $68,500, not including an allotment of $1,500 from the emergency river and harbor act of June 6, 1900, expended in 1900 in removing a shoal which had formed in Whitehall Harbor, restoring the area dredged to its former depth of 12 feet.

Before the commencement of work under the modified project of 1899 the channel, which had previously been dredged to 12 feet, had shoaled in places, restricting the draft that vessels could carry through it to not exceeding 10 feet.

Since then the shoal places in Kenyons Bay, opposite Pulpit Point and near the south end of the Narrows, have been redredged to a depth of 12 feet. This work increased the available depth for navigation from 10 to 12 feet. Booms have also been placed at and opposite Puts Rock in order to prevent vessels from colliding with the rocky bluffs at these points.

The river and harbor act of June 13, 1902, appropriated $17,500 for this work, which will be applied to the completion of the improvement.

The maximum draft that can be carried June 30, 1902, is 12 feet at mean low water.

The tonnage passing through the Narrows consists of timber, pulp, wood, salt, sugar, coal, stone, lime, clay, iron, and general merchandise, the amounts reported for the past five years being as follows:

	Tons.		Tons.
1897	519,873	1900	714,741
1898	498,731	1901	550,331
1899	848,457		

Amount appropriated by river and harbor act approved June 13, 1902	$17,500.00
July 1, 1902, balance unexpended	17,500.00

(See Appendix B 19.)

20. Removing sunken vessels or craft obstructing or endangering navigation.—During the past fiscal year the wreck of schooner *Index* was removed from the harbor of Biddeford Pool, Me., under the provisions of the act of March 3, 1899, at a total cost of $400.

(See Appendix B 20.)

IMPROVEMENT OF RIVERS AND HARBORS IN EASTERN MASSACHUSETTS SOUTH OF AND INCLUDING LYNN HARBOR.

This district was in the charge of Lieut. Col. W. S. Stanton, Corps of Engineers.

1. Harbor at Lynn, Mass.—An area of shoals extends from the wharves at Lynn 2½ miles southerly to the sea. It is protected from the sea by the peninsula of Lynn Beach and Nahant.

In its original condition three narrow and crooked channels, in which the depth was but 6 feet at mean low water, extended from the wharves to the sea.

The original project, defined in the report of a Board of Engineers dated April 10, 1884, and as modified in 1888, was to dredge a channel 200 feet wide and 10 feet deep at mean low water from the sea (at White Rocks) a distance of 3,300 feet to a deep basin opposite Little Nahant, and from the basin nearly opposite Sand Point, a distance of 6,900 feet to a point 400 feet inside the harbor line, and an anchorage basin 500 feet by 300 feet and 10 feet deep at mean low water, the upper part of the channel to be maintained by occasional dredging, the lower part by a training wall joining the land at Little Nahant.

The amount expended on this project to June 30, 1902, is $121,924.74, with which the entire channel and the anchorage basin as prescribed in the project have been completed. The building of a training wall has not been commenced, because the necessity for its construction has never been apparent.

The existing project, adopted by the river and harbor act of June 13, 1902, is to dredge the channel 200 feet wide from the sea to the anchorage basin and the anchorage basin itself to the depth of 15 feet at mean low water, at an estimated cost of $162,936.84. Under this project to the close of the fiscal year ending June 30, 1902, no money has been expended and there are no liabilities.

The maximum draft that can be carried June 30, 1902, over the shoalest part of the locality under improvement is 10 feet at mean low water. The mean range of tides is 9.3 feet.

The commerce of the harbor to be benefited by the improvement consists chiefly of coal, lumber, and building materials, of which about 400,000 tons was carried into the harbor during the year, the improvement enabling these supplies to be delivered at Lynn without breaking cargoes in Boston.

The original project approved by the Secretary of War April 21, 1884, is in the Annual Report of the Chief of Engineers for 1884, page 524, and the map of the harbor at page 532.

The existing project was published with map as House Doc. No. 78, Fifty-sixth Congress, second session, and without map in the Annual Report of the Chief of Engineers for 1901, page 1093.

PROJECT OF 1884 FOR 10-FOOT CHANNEL.

July 1, 1901, balance unexpended	$6,875.26
June 30, 1902, amount expended during fiscal year	300.00
July 1, 1902, balance unexpended	6,575.26

PROJECT OF 1900 FOR 15-FOOT CHANNEL.

Amount appropriated by river and harbor act approved June 13, 1902	25,000.00
July 1, 1902, balance unexpended	25,000.00

(See Appendix C 1.)

2. Mystic and Malden rivers, and Mystic River below the mouth of Island End River, Massachusetts.—(*a*) *Mystic River.*—In its original condition, the Mystic had a practicable channel 6 feet deep at mean low water extending to Denning's landing, 3.9 miles above its mouth in Boston Harbor, and 4 feet deep at mean low water about 2,000 feet farther.

The original project for improvement, adopted by the act of July 13, 1892, which is also the present project, is to make the channel 100 feet wide and 6 feet deep at mean low water from the Boston and Maine Railroad (Western Division) bridge up about 1 mile to the first turn above Denning's wharf, and thence 2 miles to the head of navigation, at Medford, 4 feet deep at mean low water, gradually narrowing (from 100 feet) to 50 feet at the upper end, at an estimated cost of $25,000.

The amount expended to close of the fiscal year June 30, 1902, is $15,000. With this expenditure a channel 100 feet wide and 6 feet deep at mean low water has been completed to the full length prescribed in the project, and the improvement has been carried a further distance of 4,200 feet with the width and the depth of 4 feet prescribed in the project.

The maximum draft that can be carried, June 30, 1902, at mean low water is 6 feet up to the first turn above Denning's wharf, and thence to the head of navigation 1½ feet. The mean range of tides is 9.8 feet.

The commerce benefited by this improvement consists chiefly of coal and molasses, of which about 11,000 tons is annually delivered at Medford and about 8,000 tons at Denning's wharf, in Charlestown, without breaking cargoes in Boston.

A report with map of the survey of Mystic River and description of the project, is in the Annual Report of the Chief of Engineers for 1891, page 674.

(*b*) *Malden River.*—In its original condition the Malden has a practicable channel 4 feet deep at mean low water, extending only 2,000 feet above its confluence with the Mystic.

The original project, adopted by the act of August 12, 1882, was to make the channel 100 feet wide and 12 feet deep at mean high water to the second bridge, about 1.8 miles above its confluence with the Mystic, at an estimated cost of $35,000.

The amount expended on the Malden River under the original project and prior to operations under the existing project was $10,000, in obtaining a channel with a least width of 50 feet and 70 feet at turns with a depth of 12 feet at mean high water from the mouth to the first bridge at Malden, a distance of 1¼ miles.

The existing project, adopted by the act of July 13, 1892, is to dredge a channel 12 feet deep at mean high water 100 feet wide to the first bridge, 1.6 miles above its confluence with the Mystic, and 75 feet wide about 1,200 feet farther to the second bridge, at an estimated cost of $37,000.

The amount expended under the existing project to June 30, 1902, is $22,500, of which $7,513.61 was expended for maintenance.

With it a channel was obtained 100 feet wide and 12 feet deep at mean high water up to the first bridge. The local officer has reported the river above this point to be unworthy of improvement by the United States at this time.

The maximum draft that can be carried at mean high water, June 30, 1902, over the shoalest part of the improved channel is 10 feet. The mean range of tides is 9.8 feet.

A report of the survey of Malden River and description of the original project is on page 532, Annual Report of the Chief of Engineers for 1881.

The modifications of the project are stated in the Annual Report of the Chief of Engineers for 1900, page 1191.

The existing project is described on page 672, Annual Report of the Chief of Engineers for 1891.

(*c*) *Mystic River below the mouth of Island End River.*—Island End River is 1¼ miles above the mouth of the Mystic, at the navy-yard in Charlestown and 2,700 feet above the Chelsea drawbridge, over the Mystic.

In its original condition the Mystic up to Island End River had a narrow channel 14.4 feet deep at mean low water, but so narrow above the drawbridge as to be barely practicable.

The original project, adopted by the act of March 3, 1899, which is also the existing project, is to dredge a channel 25 feet deep at mean low water and 300 feet wide, embracing 1.7 miles of the Mystic, extending from its mouth to a point 800 feet above Island End River, at a cost estimated in August, 1899, at $267,547.50 (reduced estimate).

To June 30, 1902, $47,713.12 has been expended obtaining a channel 25 feet deep at mean low water, with a minimum width of 100 feet up to Chelsea drawbridge and 125 to 240 feet in width from Chelsea drawbridge to Island End River.

The maximum draft that can be carried June 30, 1902, over the shoalest part of the locality under improvement is 25 feet. The mean range of tides is 9.6 feet.

The commerce of the Mystic River below the mouth of Island End River amounts annually to 1,430,650 tons, chiefly coal and lumber, of which 80,650 tons is carried above the locality of this improvement to the Upper Mystic and Malden.

A report of the survey of the river was published in the Annual

Report of the Chief of Engineers for 1899, page 1097. No map has been published.

July 1, 1901, balance unexpended	$5,058.88
Amount appropriated by river and harbor act approved June 13, 1902	25,000.00
	30,058.88
June 30, 1902, amount expended during fiscal year	272.00
July 1, 1902, balance unexpended	29,786.88

(See Appendixes C 2 and 3.)

3. Harbor at Boston, Mass.—In its original condition the headlands and islands were without protection against the sea, which was extensively eroding them. Dangerous rocks obstructed the approach and entrance from Nantasket Roads to the lower main ship channel through the Narrows. That channel was 23 feet deep at mean low water with a least width of 150 feet. The upper main ship channel from President Roads to Boston had a least depth of 18 feet at mean low water with a least width of 100 feet. The channel from President Roads to Broad Sound in the ocean had a least depth of 29 feet at mean low water with a least width of 200 feet.

The original project, act of March 3, 1825, was "for the preservation of the islands in Boston Harbor necessary to the security of that place," and until 1866 all expenditures, amounting to $546,526.10, appear to have been applied to that purpose in the building and repair of permanent sea walls. The amount expended upon them since 1866 can not be accurately stated.

The original project for the improvement of the harbor adopted by the act of March 2, 1867, was (as modified) to make the main ship channel from Nantasket Roads to Boston 23 feet deep at mean low water, 600 feet wide through the Narrows to President Roads, and 1,000 feet wide from President Roads to Boston.

Prior to operations under the existing project and to this date 3.75 miles of sea walls had been built, protecting the most exposed headlands and islands, and a channel had been completed 23 feet deep at mean low water from Nantasket Roads to Boston, with a least width of 625 feet in the Narrows and of 850 feet between President Roads and the city.

The amount expended on original and modified projects from 1825 to June 30, 1902, upon sea walls and channels, for improvement and maintenance, is $2,300,937.37.

This amount is exclusive of all expenditures on the six existing projects, for the three harbor channels, and the three tributary channels, which follow:

The existing projects are—

1. Adopted by the river and harbor act of July 13, 1892. To widen the main ship channel, from Nantasket Roads to Boston, to 1,000 feet, and to deepen it to 27 feet at mean low water, at an estimated cost of $1,250,000, subsequently increased to $1,488,751.

2. Adopted by the river and harbor act of March 3, 1899. To widen the Broad Sound channel to 1,200 feet, and to deepen it to 30 feet at mean low water, at an estimated cost of $455,000.

3. Adopted by the river and harbor act of June 13, 1902. To provide channels 35 feet deep at mean low water, 1,200 feet wide from the navy-yard at Charlestown and the Chelsea bridge and Charles

River bridge to President Roads, and 1,500 feet wide from President Roads through Broad Sound to the ocean, at an estimated cost of $7,994,248.68. (To avoid a large amount of rock excavation the 35-foot channel from President Roads to Broad Sound is in a different location from the 30-foot channel.)

Project of July 13, 1892.—The main ship channel has been dredged to the full width of 1,000 feet from Nantasket Roads to Boston, and to the depth of 27 feet at mean low water, excepting some ridges and lumps left in the upper main ship channel by the dredge.

In the upper main ship channel one-half its width, 500 feet, has been cleared of ledges by the removal of several groups, covering about one acre. Ledges remaining to be removed make the least width of the channel, 27 feet deep at mean low water, 500 feet in the upper and 450 feet in the lower main ship channels.

To June 30, 1902, there was expended on this project, not including outstanding liabilities, $1,065,308.08, all for improvement.

The maximum draft that can be carried at mean low water June 30, 1902, over the shoalest part of the locality under improvement is in the upper main ship channel, from President Roads to Boston, 26 feet, and in the lower main ship channel, from President Roads to the sea, 27 feet, unless ledges not detected by the soundings be revealed by the sweeping of that channel, which is in progress at the close of the fiscal year.

A map of the project is in Annual Report of the Chief of Engineers for 1894, page 554.

Project of March 3, 1899.—The Broad Sound channel has been dredged to the depth of 30 feet at mean low water from President Roads to the sea, with a least width of 780 feet.

The amount expended under this project to June 30, 1902, not including outstanding liabilities, is $196,095.18, all for improvement.

The maximum draft that can be carried through the channel June 30, 1902, is 30 feet at mean low water, so far as is known until the channel is swept for obstructions not revealed by the soundings.

The project is published with map in House Doc. No. 133, Fifty-fifth Congress, second session, and without map in Annual Report of the Chief of Engineers for 1898, page 886.

Project of June 13, 1902.—This project, modified and adopted by the act of June 13, 1902, was published with map in House Doc. No. 119, Fifty-sixth Congress, second session, and without map in Annual Report of the Chief of Engineers for 1901, page 1098.

There have been no expenditures under this project.

The mean range of tides is 9.5 feet at Boston light and 9.6 feet in the upper harbor.

The commerce chiefly benefited by the improvement is the export of grain. From report of the Boston Chamber of Commerce for 1901 it appears that 11,925,415 bushels of wheat was exported in the calendar year 1900 and 20,084,378 bushels in the calendar year 1901; that 16,132,786 bushels of corn was exported in the calendar year 1900 and 11,535,305 bushels in 1901; that 1,609,015 barrels of flour was exported in the calendar year 1900 and 1,468,971 barrels in the calendar year 1901—the total exports of wheat, corn, and flour amounting in 1900 to 967,163 tons and in 1901 to 1,069,478 tons.

The additional improvement by the 35-foot project is for the purpose of extension of benefits by the admission to the port of grain carrying and passenger ships of modern dimensions and deep draft.

The number of cabin passengers who arrive in Boston annually by these steamers has doubled, and of those who sailed has quadrupled in the ten years since 1891. In the calendar year 1901, 11,698 cabin passengers and 27,327 steerage passengers arrived and 8,236 cabin passengers and 9,804 steerage passengers sailed; total, 57,065. Instead of former indirect sailings from Boston for Hamburg, there were, in 1900, two, and in 1901 fifteen clearances for that port, being practically the establishment of a direct line between Boston and Hamburg.

Tributary channels.—(*a*) *Charles River.*—In the original condition of the 9 miles of natural channel of this river from its mouth to the dam at the head of navigation at Watertown the depth at mean low water, from the mouth 4¾ miles to the Western Avenue Bridge, was not less than 7 feet except in several places, covering about 1¼ miles, below Brookline bridge, where the depth varied from 4½ to 7 feet. From Western Avenue Bridge 2½ miles to the Arsenal Street Bridge the depth was 4 feet. Thence 1¾ miles to the dam it varied between 0 and 9½ feet.

The original project, adopted by the act of June 14, 1880, which is also the existing project, is to widen and deepen the natural channel so that at mean low water it shall be from its mouth to Western Avenue Bridge 200 feet wide and not less than 7 feet deep; thence to Market Street Bridge 80 feet wide and 6 feet deep; thence to the dam 60 feet wide and 2 feet deep; at an estimated cost of $125,000.

The amount expended to June 30, 1902, is $57,500, all for improvement, with which the channel has been completed as prescribed in the project up to the Arsenal Street Bridge (now called also Western Avenue Bridge).

The maximum draft that can be carried June 30, 1902, at mean low water over the shoalest part of the locality improved is 6 feet. The mean range of tides is 9.3 feet.

The improvement serves an annual commerce comprising 99,000 tons of coal, 5,000,000 feet of lumber, which, together with wood and lime, amount to about 110,000 tons annually, enabling it to be delivered without breaking cargoes at Boston, saving the cost of one handling and the greater cost of transportation from Boston by rail.

A full description of the project, together with map of the river showing the progress of the improvement to this date, is on page 512, Annual Report of the Chief of Engineers for 1884.

(*b*) *Fort Point Channel.*—In its original condition the mid-channel depth was 12 feet at its mouth and 16 feet thence to the Federal Street Bridge, excepting at the draw in the Congress Street Bridge, where it was 14.5 feet at mean low water.

The original project, adopted by the act of August 5, 1886, which is also the existing project, is to dredge a channel 175 feet wide and 23 feet deep at mean low water from the entrance about 4,190 feet to near Federal Street Bridge, at an estimated cost of $100,000.

To June 30, 1902, there has been expended $18,027, all for improvement, with which a channel was obtained of the width and depth prescribed in the project from its entrance to the Congress Street Bridge, with an extension carried through the north draw to near the western extremity of the "rest pier."

The maximum draft that can be carried June 30, 1902, at mean low water over the shoalest part of the improved channel is 23 feet. The mean range of tides is 9.6 feet.

The commerce benefited by this improvement consists of coal, sugar,

molasses, and building materials, of which about 313,000 tons is delivered annually at wharves located upon that portion of Fort Point Channel embraced in the improvement.

The condition of the channel, the report of the survey of the channel, and the description and estimate of cost of the project are in the Annual Report of the Chief of Engineers for 1885, page 545. The rates obtained in 1886 for dredging were much lower than the estimate, and on page 516, Annual Report of the Chief of Engineers for 1887, the total estimated cost of the project was reduced to $78,750.

(c) *Chelsea Creek.*—In its original condition it had a channel of practicable width extending 11,000 feet from its confluence with Mystic River in Boston Harbor and 18 feet deep at mean high water, except on a bar about 2,000 feet below its head, upon which the depth was 17 feet. In the 3,300 feet from the head of the 18-foot channel to the head of navigation the depth gradually shoaled to 13 feet at mean high water.

The original project adopted by the act of June 3, 1896, which is also the existing project, is to make the channel about 5,500 feet in length next below the head of navigation, 150 feet wide, and 18 feet deep at mean high water, at an estimated cost of $65,000.

The amount expended under this project to June 30, 1902, not including outstanding liabilities, is $7,030.80, all for improvement, with which in 1896 a channel 14 feet deep at mean high water and nowhere less than 35 feet wide had been dredged from the head of the 18-foot channel upstream 2,800 feet to a little above Proctor's wharf, and a survey had been made for further improvement.

June 2 to June 30, 1902, the dredging of a channel 75 feet wide and 18 feet deep at mean high water through the bar, and a channel 50 to 150 feet wide, 14 feet deep at mean high water, and 2,800 feet in length from the head of the 18-foot channel from Proctor's wharf, 500 feet below the head of navigation, have been nearly completed.

June 30, 1902, the maximum draft that can be carried at mean high water over the shoalest part of the improved channel is 14 feet.

The mean range of tides is 9.6 feet.

PROJECT FOR GENERAL IMPROVEMENT.

July 1, 1901, balance unexpended	$79,521.13
Amount appropriated by river and harbor act approved June 13, 1902	100,000.00
	179,521.13
June 30, 1902, amount expended during fiscal year	35,585.49
July 1, 1902, balance unexpended	143,935.64
July 1, 1902, outstanding liabilities	7,598.51
July 1, 1902, balance available	136,337.13
July 1, 1902, amount covered by uncompleted contracts	1,186.25

PROJECT OF 1892.

July 1, 1901, balance unexpended	$356,055.40
Amount appropriated by sundry civil act approved June 28, 1902	175,000.00
	531,055.40
June 30, 1902, amount expended during fiscal year	90,767.19
July 1, 1902, balance unexpended	440,288.21
July 1, 1902, outstanding liabilities	61,836.31
July 1, 1902, balance available	378,451.90
July 1, 1902, amount covered by uncompleted contracts	187,911.32

PROJECT FOR BROAD SOUND CHANNEL.

July 1, 1901, balance unexpended	$405,625.03
June 30, 1902, amount expended during fiscal year	146,720.21
July 1, 1902, balance unexpended	258,904.82
July 1, 1902, outstanding liabilities	24,841.08
July 1, 1902, balance available	234,063.74
July 1. 1902, amount covered by uncompleted contracts	86,854.04

PROJECT OF 1902.

Amount appropriated by river and harbor act approved June 13, 1902.	$600,000.00
July 1, 1902, balance unexpended	600,000.00
Amount (estimated) required for completion of existing project	7,394,248.68
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	600,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix C 4.)

4. Town and Weymouth rivers, Massachusetts.—(*a*) *Town River.*—In its original condition Town River had a good channel not less than 7 feet deep at mean low water, extending 4,000 feet from its confluence with Weymouth River.

At that distance the channel suddenly shoaled to less than 4 feet, and was 1 to 2 feet deep for a distance of 3,300 feet, and was about 18 inches above low water for a further distance of about 1,200 feet to the upper wharves at Quincy.

The original project adopted by the river and harbor act of June 3, 1896, which is the present project, is to dredge the channel 4,500 feet long to the upper wharves at Quincy, to the width of 100 feet and depth of 4 feet at mean low water, at a cost estimated August 7, 1896, at $25,000.

To June 30, 1902, the amount expended was $17,754.92, all for improvement.

With this expenditure the lower 1,400 feet and the upper 1,000 feet of the channel 4,500 feet long have been dredged to the width of 50 feet, and the intermediate 2,100 feet to the full width of 100 feet and the depth of 4 feet at mean low water.

The maximum draft that can be carried on June 30, 1902, up to the head of the section dredged to 100 feet wide is 3 feet at mean low water; thence to the head of navigation there is no low-water channel. The mean range of tides is 9.4 feet.

The commerce benefited by the improvement consists of coal, lumber, and stone, of which about 100,000 tons are annually carried through the improved channel in vessels and barges.

The original project, with map, was published as House Ex. Doc. No. 155, Fifty-first Congress, second session. The report of survey, without map, is in the Annual Report, Chief of Engineers, for 1891, page 679.

(*b*) *Weymouth River.*—In its original condition at mean low water Weymouth River was navigable from its mouth in Nantasket Roads, Boston Harbor, 4 miles, to near its confluence with Town River, for vessels drawing 18 feet; 3,700 feet farther the depth at mean low water was 12 feet, and 4,000 feet farther it was 6 feet in a channel of

practicable width; 7,000 feet farther the depth was 3 feet and the channel too narrow to be practicable.

Weymouth (Back) River had a practicable channel not less than 200 feet wide and not less than 12 feet deep at mean low water from its confluence with Weymouth River, 8,000 feet, to the wharf of the Bradley Fertilizer Company, except on its bar 400 feet across, one-fourth of a mile above its mouth, where the depth was 11 feet, and except the 2,000 feet next below the wharf of the fertilizer company, where the depth gradually shoaled from 12 feet to 6 feet at mean low water.

The original project, adopted by the act of September 19, 1890, which is also the existing project, is to obtain in Weymouth River a navigable channel 6 feet deep at mean low water for the further distance of 7,000 feet, 100 feet wide to near Weymouth Landing, 80 feet wide thence to Braintree bridge, and 50 feet wide above that point; and as extended by the act of August 18, 1894, to dredge in Weymouth (Back) River a channel 12 feet deep at mean low water 200 feet wide through the bar and to extend the channel 12 feet deep at mean low water and 200 feet wide, 2,200 feet to the wharf of the Bradley Fertilizer Company, at an estimated cost for Weymouth River of $40,000, and for Weymouth (Back) River of $22,000, a total of $62,000.

The amount expended on this project to the close of the fiscal year ending June 30, 1902, is, for Weymouth River $37,323.01, and for Weymouth (Back) River $11,753.59, all for improvement.

This expenditure has resulted in deepening the channel in Weymouth River to 6 feet through the entire 7,000 feet of the river embraced in the project to the width of at least 100 feet for a distance of 3,325 feet from its lower end, 60 feet wide for a further distance of 1,650 feet, and of the full projected width for the further distance of 1,625 feet. In Weymouth (Back) River of the 2,400 feet of the channel embraced in the project, 400 feet on the bar has been dredged to the full width and depth prescribed in the project, and the 2,000 feet extending to the Bradley Fertilizer Company's wharf to the depth of 12 feet at mean low water and the width of 125 feet.

The maximum draft that can be carried, June 30, 1902, at mean low water over the shoalest part of the locality under improvement is, in the Weymouth River 4 feet, and in the Weymouth (Back) River 10 feet. The mean range of tides is 9.4 feet.

The annual commerce of Weymouth River comprises coal, lumber, and building materials, amounting to about 48,000 tons, and of Weymouth (Back) River about 100,000 tons, of which there are about 5,000 tons of coal and 95,000 tons of raw and manufactured fertilizer products. The improvement enables about 43,000 tons of coal and about 4,000,000 feet of lumber to be delivered annually at Weymouth Landing, Braintree, and Quincy without breaking cargoes in Boston.

A report of the survey of Weymouth (Back) River is in the Annual Report of the Chief of Engineers for 1891, page 683, and a map with description of the project was published as House Ex. Doc. No. 256, Fifty-first Congress, second session.

July 1, 1901, balance unexpended	$1,191.89
Amount appropriated by river and harbor act approved June 13, 1902	15,000.00
	16,191.89
June 30, 1902, amount expended during fiscal year	23.41
July 1, 1902, balance unexpended	16,168.48

(See Appendixes C 5 and 6.)

5. Harbor at Cohasset, Mass.—In the original condition of this harbor the distance from the depth of 4 feet at mean low water in its roadstead was 4,600 feet through shoals of sand and mud to the depth of 4 feet at mean low water in a narrow channel extending with not less than that depth about 1,000 feet to the wharf. The least depth on the intervening shoaling was 0.7 foot.

The original project adopted by the act of June 13, 1902, which is the present project, is to dredge a channel to the depth of 4 feet at mean low water from the roadstead to the wharf, 60 feet wide, increasing to 75 feet at the curve, and to dredge a turning basin in the harbor, 350 by 350 feet, at an estimated cost of $21,670.

No money has been expended upon this project.

The mean range of tides is 9.4 feet.

The commerce involved in this improvement is reported to be the transportation into the harbor of about 2,000 tons of coal, 670 tons of lumber, and 500 tons of bricks, amounting to about 3,170 tons annually.

A description of the project, with map, was printed in House Doc. No. 284, Fifty-sixth Congress, first session, and, without map, in the Annual Report of the Chief of Engineers for 1900, page 1222.

Amount appropriated by river and harbor act approved June 13, 1902...	$10,000.00
July 1, 1902, balance unexpended	10,000.00

(See Appendix C 7.)

6. Harbor at Scituate, Mass.—In its original condition the depth on the bar was about 2.5 feet at mean low water, and the entrance was obstructed by many sunken bowlders; of the low-water area of about 57 acres, 6 acres had a depth of at least 3 feet at mean low water and there was little protection against the sea.

The original project seems to have been to protect the beach between Cedar Point and the mainland on the northerly side of the entrance to the harbor, upon which, prior to operations under the existing projects (in 1829 to 1852), $1,180 was expended in building 450 linear feet of brush and stone bulkhead and 385 linear feet of stone apron 10 feet wide.

The existing project, adopted by the act of June 14, 1880, is to build, of rubble stone, a north breakwater 800 feet and a south breakwater 730 feet long, to dredge an anchorage basin of 30 acres and an entrance channel 2,700 feet long and 300 feet wide, with depths at mean low water of 15 feet at the entrance, 12 to 15 feet between the breakwaters, 12 feet immediately back of the south breakwater, 10 feet in the anchorage basin, and 3 feet in the channel to the wharves, at an estimated cost of $100,000 for the breakwaters and of $190,000 for the dredging; total, $290,000.

Up to the close of the fiscal year ending June 30, 1902, there had been expended on the work under the existing project $103,351.94, of which $1,989.11 was expended for maintenance during the last two fiscal years. The amount previously expended for maintenance is not ascertainable.

With that expenditure all known bowlders obstructing the entrance to the harbor have been removed; the anchorage basin, 350 feet by 400 feet, has been dredged 7 feet at mean low water, and the channel from the sea to the basin has been dredged 7 feet deep, 100 feet wide, and 1,600 feet long; the channel, 2,150 feet long from the anchorage basin to the town wharves, has been dredged 3 feet at mean low water at

least 100 feet wide, and 720 linear feet of the north breakwater and 450 linear feet of the south breakwater have been built. The local officer has reported the locality to be unworthy of further improvement except for maintenance.

The maximum draft that can be carried at mean low water, June 30, 1902, over the shoalest part of the locality under improvement is through the entrance channel and basin 7 feet and through the channel from the basin to the town wharves 20 inches at mean low water. The mean range of tides is 9.8 feet.

The commerce benefited by the improvement of this harbor consists of coal, lumber, and building materials, of which about 15,000 tons is received annually.

The existing project as reported by a Board of Engineers, September 18, 1880, with map of the harbor, is published in Annual Report of the Chief of Engineers for 1881, page 523.

July 1, 1901, balance unexpended	$1,892.74
June 30, 1902, amount expended during fiscal year	1,744.68
July 1, 1902, balance unexpended	148.06

(See Appendix C 8.)

7. *Harbor at Duxbury, Mass.*—This harbor has two channels leading from deep water in the "Cow Yard" in Plymouth Harbor. The easterly channel to the east of Captains Hill is in Duxbury Bay, an extensive area of sandy shoals separated from the ocean by Duxbury Beach, a slender beach about 4½ miles in length; the westerly channel, known as the Miles Channel, leads into Kingston Bay, west of Captains Hill.

In its original condition the easterly channel had a practicable width with a depth of 6 feet at mean low water to a point 2,600 feet from the wharf at Duxbury in Duxbury Bay, and the Miles Channel a depth of 8 feet at mean low water and a practicable width to a point 2,100 feet from the wharf at Duxbury in Kingston Bay.

The original projects appear to have been—

1. For the protection of the beach, authorized by the act of July 4, 1836, by building groins of stakes and brush.

2. For the improvement of the channel authorized by the act of June 10, 1872, to extend the Miles Channel by dredging to the depth of 8 feet and width of 200 feet for a distance of 2,300 feet from a point 200 feet above the wharf at Duxbury in Kingston Bay.

On these projects there was expended prior to operations under existing project $25,000, with which some protection was given to Duxbury Beach, and the Miles Channel was extended the aforesaid distance with the aforesaid depth and width.

The existing project, approved by the Secretary of War August 12, 1899 (a modification of a project submitted November 28, 1887), is to dredge a channel 6 feet deep at mean low water 60 feet wide, increasing to 100 feet on the curve, from the southerly wharf at Duxbury in Duxbury Bay 3,600 feet to the head of the easterly channel, at an estimated cost (as increased in 1899) of $17,820.

To the close of the fiscal year ending June 30, 1902, there has been expended under the existing project $12,000, all for improvement. With this expenditure the easterly channel has been extended with the depth of 6 feet the entire distance of 3,600 feet to the wharf with a width of 80 feet at the wharf, 60 feet at the turn, and 40 feet elsewhere.

The maximum draft that can be carried over the shoalest part of the improvement at mean low water, June 30, 1902, is 5 feet. The mean range of tides is 9.3 feet.

The commerce benefited by the improvement of Duxbury Harbor consists of coal, lumber, and building materials, of which about 1,800 tons is received annually.

The project for beach protection, adopted in 1836, is in the Annual Report of the Chief of Engineers for 1866, Part II, page 36.

The original project for improving the harbor is in Annual Report of the Chief of Engineers for 1872, pages 947 and 964.

The existing project (without modifications approved August 12, 1899) is in Annual Report of the Chief of Engineers for 1888, page 473, together with maps of the harbor. No map or description of the channel as modified under the project of 1899 has been published.

July 1, 1901, balance unexpended	$96.26
June 30, 1902, amount expended during fiscal year	96.26

(See Appendix C 9.)

8. Harbors at Plymouth and Provincetown, Mass.—(*a*) *Plymouth Harbor.*—In the original condition of the harbor the channel and low-water line were about 2,500 feet from the wharf at Plymouth. Long Beach, between the harbor and the ocean, was, for the most part, low and narrow, and liable to inroads by the sea that would injure or destroy the harbor.

All projects and expenditures prior to 1875 appear to have been for the construction of works for the preservation of the beach.

The original project for the improvement of the channel, adopted by the act of March 3, 1875, was to dredge a channel, 100 feet wide and 6 feet deep at mean low water, through the flats from the channel in the inner harbor to Long Wharf in Plymouth, at an estimated cost of $28,000.

Prior to operations under the existing project $190,634.38 had been expended in preserving Long Beach and in dredging under the project of March 3, 1875, as modified, which resulted in obtaining a channel 150 feet wide and 9 feet deep and a basin directly in front of the town wharves 866 feet long, 150 feet wide, and 9 feet deep. Of this amount $60,727.52 was expended for maintenance.

The existing project for the protection of the beach, adopted by the act of March 3, 1899, is to strengthen the sections of beach damaged by the great storm of November, 1898, and to restore Eel River to its former course, discharging into the head of the harbor from its present course into the sea, to which it was changed by the storm, at an estimated cost of $95,700. The local officer has reported the project to be unworthy of prosecution so far as it relates to Eel River, and so far only.

The amount expended on the work of the existing project to the close of the fiscal year ending June 30, 1902, is $58,332.69, with which 10,468 linear feet of rubblestone dike was built on Long Beach, which has resulted in strengthening the beach by the accretion of a large volume of sand and beach shingle.

The maximum draft that can be carried June 30, 1902, at mean low water over the shoalest part of the improved channel is 7.5 feet, and of the basin 7 feet. The mean range of tides is 10.1 feet.

The commerce benefited by this improvement consists of coal and

lumber, of which 29,000 tons and 3,000,000 feet, respectively, were carried into the harbor during the fiscal year.

The original project for dredging is published in the Annual Report of the Chief of Engineers for 1874, Part II, page 348. A map of the dredged channel and basin is printed in the Annual Report of the Chief of Engineers for 1888, page 460.

(*b*) *Provincetown Harbor.*—This is an important harbor of refuge in the bight at the extremity of Cape Cod.

In its original condition the width and depth of its entrance and the depth of its anchorage were ample for the largest vessels, but actual or threatened inroads by the sea across the low and narrow part of the cape east of the town and at intervals along about 1½ miles of the narrow beach southwest of the town were a serious menace to the harbor.

The original project, adopted by the act of May 19, 1826, was "for the preservation of the point of land forming Provincetown Harbor, Massachusetts."

The project from 1826 continuously to this date has been, by building dikes and groins and by other sand-catching devices, to arrest the erosion and promote the accretion of the barriers of beach and sand dunes which protect and preserve the harbor.

The amount expended to June 30, 1902, is $160,030.42, all applied to improvement.

The result of the expenditure has been the preservation of the barriers of beach and sand dunes essential to the preservation of the harbor.

The maximum draft that can be carried, June 30, 1902, to the anchorage is ample for the largest vessels.

A description and plan of works are in the Annual Reports of the Chief of Engineers for 1876, 1879 and 1886, pages 181, 273, and 574, respectively.

A special project for the protection of the most slender part of the beach southwesterly of Provincetown is published, with map, in House Doc. No. 8, Fifty-fifth Congress, first session (see Annual Report of the Chief of Engineers for 1897, p. 878).

July 1, 1901, balance unexpended	$61,185.43
Amount appropriated by river and harbor act approved June 13, 1902	15,000.00
	76,185.43
June 30, 1902, amount expended during fiscal year	36,497.58
July 1, 1902, balance unexpended	39,687.85

(See Appendixes C 10 and 11.)

8. Harbor at Chatham, Mass.—In its original condition the tortuous channel 2½ miles long from Chatham Roads to the wharves at Chatham had a ruling depth of not less than 7 feet at mean low water except on three bars where the depth was 4 to 4½ feet and whose total length was about 2,000 feet.

The original project, adopted by the act of September 19, 1890, which is also the existing project, is to dredge a channel 6 feet deep at mean low water 200 feet wide through the outer, 150 feet wide through the middle, and 100 feet wide through the inner bar, at an estimated cost (adopted by act of March 3, 1899) of $13,732.79.

To June 30, 1902, there has been expended upon the improvement

$12,171.36 of which $4,282.41 was for maintenance. With this expenditure channels have been obtained through the three bars of the full width and depth prescribed in the project.

The maximum draft that can be carried, June 30, 1902, at mean low water over the shoalest part of the locality under improvement is 6 feet, unless shoaling has occurred in the seven months since the dredging was finished. The mean range of tides is 5 feet.

The commerce of the harbor consists chiefly of coal and lumber, which with general merchandise received and shipped at this port, amounts to about 6,200 tons annually.

A description of the harbor and of the project for its improvement is in the Annual Report of the Chief of Engineers for 1900, page 1217.

July 1, 1901, balance unexpended	$8,179.86
June 30, 1902, amount expended during fiscal year	6,618.43
July 1, 1902, balance unexpended	1,561.43

(See Appendix C 12.)

9. Removing sunken vessels or craft obstructing or endangering navigation.—Under provisions of sections 19 and 20 of the river and harbor act of March 3, 1899, fragments of the wrecks of the schooners *Ira Laffrinier* and *Mondego* were moved from the channel in Nauset Harbor, Massachusetts, at a total cost of $381.71.

(See Appendix C 13.)

IMPROVEMENT OF RIVERS AND HARBORS IN SOUTHEASTERN MASSACHUSETTS AND IN RHODE ISLAND.

This district was in the charge of Maj. George W. Goethals, Corps of Engineers, having under his immediate orders Lieut. R. P. Johnston, Corps of Engineers, to August 10, 1901. Division Engineer, Col. Chas. R. Suter, Corps of Engineers.

1. Harbors at Hyannis and Nantucket, Mass.—(*a*) *Harbor of refuge at Hyannis.*—This harbor, before improvement, was an open roadstead exposed to southerly storms.

In the years 1827–1838 a breakwater 1,170 feet long was constructed of riprap granite, covering an anchorage of about 175 acres, the entrance to which has a depth of about 15.5 feet.

Between the years 1852 and 1882 extensive repairs were made, increasing the width of the base of the breakwater and the size of the stone forming its sides and top.

The sum of $123,431.82 had been expended at this harbor prior to operations under existing project.

The existing project, approved in 1884, provides for dredging to 15.5 feet depth at low water about 36 acres area north of the existing breakwater, so as to increase the deep-water anchorage by that amount, all at a total cost estimated at that time at $45,743.20, increased $32,500 in accordance with report of December 2, 1899, by river and harbor act of June 13, 1902, making the total estimated cost $76,312.14.

At the adoption of the existing project the 15.5-foot depth anchorage covered only about 47 acres, and the 36 additional acres to be dredged carried a depth of from 7 to 15.5 feet of water at low water.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1902, exclusive of outstanding liabilities, was $43,821.57, none of which was applied to maintenance. Of the

36 acres, 26.6 has been deepened to 15.5 feet and two cuts 25 feet wide and 13 feet deep at mean low water, have been made in the channel leading to the wharf of the New York, New Haven and Hartford Railroad Company.

The mean rise and fall of the tide is about 3 feet.

No work was done during the past fiscal year.

The principal value of this harbor to commerce is as a harbor of refuge for coasters and fishing vessels. The actual commerce of the place is, in general, agricultural products, coal, and fish, aggregating 29,000 tons. The increase of anchorage area will afford refuge for more and larger boats.

The unexpended balance will be applied to extending the 15.5-foot depth anchorage area by dredging.

A plan of the works may be found in the Annual Report of the Chief of Engineers for 1885, pages 560 and 621, and report of survey of 1899 in the Annual Report for 1900, page 1284; also published with map as House Doc. No. 79, Fifty-sixth Congress, first session.

(*b*) *Harbor of refuge at Nantucket.*—This harbor is the only one between the harbors of Marthas Vineyard (Vineyard Haven and Edgartown) and Provincetown, a distance of 100 miles, except the small harbor of Hyannis, on the north side of Nantucket Sound. It has considerable area, with a depth of water in excess of 12 feet, and the object of the improvement is to make it a harbor of refuge for vessels plying between ports north and south of Cape Cod.

In its original condition the channel entrance was barred by a shoal 1.5 miles in width, on which there was only 6 feet of water at low tide, the channel being very crooked and subject to changes in location.

Between 1829 and 1844 an ineffectual attempt was made to dredge a channel through the bar; $45,734.75 was expended prior to beginning operations under the existing project.

The present project, adopted in 1880 and modified in 1885, provides for the construction of two jetties, one on each side of the entrance, and for dredging when necessary, in order to obtain a channel depth of from 12 to 15 feet at low water. Estimated cost, $375,000.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1902, exclusive of outstanding liabilities, was $260,000, of which $7,210 was expended in repairs to the west jetty.

About 83 per cent of the west jetty and 53 per cent of the east jetty have been constructed. The least channel depth is 8 feet.

The mean rise and fall of the tide is about 3 feet.

During an unusually severe storm in December, 1896, a breach was made through the Haulover Beach between the ocean and the head of the harbor. The breach still remains open, but it does not appear to have affected the depth of water in the entrance to the harbor.

A large portion of the 3,955 feet of the west jetty, built prior to 1884, has been damaged somewhat by storms and ice, and having no core of small stone allows considerable sand to pass through it. This should be repaired so as to be as sand-tight as possible, and raised to its original height. It is estimated that $30,000 will be required to complete the repairs, in addition to the estimated cost of the project.

No works of improvement were in progress during the past fiscal year.

Further work will consist in raising the incomplete portions of both jetties and extending the same, with a view to the extension of the benefits to be derived from the improvement.

The entire commerce of Nantucket is carried on at this harbor,

amounting in 1901 to about 25,813 tons. The effect of this work will be to afford a place of refuge easy of access and secure from storms for coasters and fishing vessels.

The original reports upon which the existing project was based and subsequently modified may be found in the Annual Reports of the Chief of Engineers for 1880, page 432, and for 1885, pages 563–578.

July 1, 1901, balance unexpended	$1,862.00
Amount appropriated by river and harbor act approved June 13, 1902	35,000.00
	36,862.00
June 30, 1902, amount expended during fiscal year	.89
July 1, 1902, balance unexpended	36,861.11

(See Appendixes D 1 and 2.)

2. Harbor at Vineyard Haven, Massachusetts.—Vineyard Haven is a deep indentation in the northern shore of the island of Marthas Vineyard, on the southern side of Vineyard Sound.

The headlands on either side of the entrance to the harbor were gradually wearing away and the adjacent parts of the harbor were shoaling. The mean range of tide is 1.7 feet.

The existing project of 1887, as modified in 1889, provides for the protection of the "Chops" (or headlands) from erosion and the intervening harbor from being filled with the eroded material, the whole to be done by means of stone sea walls and jetties built along the beach in front of the bluffs at both headlands. The total cost was estimated in 1889 at $60,000, the whole of which has been appropriated.

The sum of $55,387.35 had been expended on this work up to June 30, 1902, by which there had been built a riprap sea wall of 1,210 feet length and a jetty of 50 feet length and six small spurs extending back from the sea wall to the foot of the bluff at the East Chop, and at the West Chop a riprap sea wall of 880 feet length, three jetties of 150, 135, and 280 feet length, a wharf, and a short breakwater of 60 feet length, and 2,400 feet length of riprap wall along the low-water line, and thirteen short jetties running from the sea wall to the foot of the bluff, in front of the bluff on the east side of the West Chop. The works so far constructed appear to have afforded the needed protection.

During the past fiscal year no work of improvement was in progress. An examination of the harbor, "with a view to its further protection and improvement as a harbor of refuge by a breakwater or otherwise," was made in September, 1899, and report thereon transmitted to Congress and printed in House Doc. No. 66, Fifty-sixth Congress, first session; it is also printed in Annual Report of the Chief of Engineers for 1900, page 1289.

The river and harbor act of June 13, 1902, provides that "A board of engineers shall be appointed by the Secretary of War, who shall make * * * an examination of Vineyard and Nantucket sounds and the east shore of Cape Cod, with a view to reporting upon the relative merits of each of said proposed localities for harbors of refuge. * * * The expense of said board shall be paid from the unexpended balance remaining to the credit of the entrance to Point Judith Pond."

July 1, 1901, balance unexpended	$5,032.65
June 30, 1902, amount expended during fiscal year	420.00
July 1, 1902, balance unexpended	4,612.65

(See Appendix D 3.)

3. Woods Hole Channel, Massachusetts.—Woods Hole is a waterway or strait connecting Buzzards Bay and Vineyard Sound and lying near the southwestern part of Cape Cod, Massachusetts. The name is also applied to the village in the near vicinity and to the Great Harbor and Little Harbor.

Before the improvement the entrance to Little Harbor was obstructed by a bar with but 7.5 feet on it at mean low tide. Great Harbor has ample depth. In the strait the channels were crooked and obstructed by bowlders, and the velocity of the currents at certain stages of the tide was from 5 to 7 miles per hour. The site of the wharves and basins of the United States Fish Commission and Revenue-Marine Service was a submerged point of land from the shore of Great Harbor.

The original project of 1879 provided for making a channel through the bar at the entrance to Little Harbor and widening and deepening the channel through the strait. The project of 1883, extended in 1884 and 1886, provided for the construction of retaining walls on shore, a stone pier, and a wooden wharf, mainly for the use of the United States Fish Commission and incidentally for the use of the other branches of the public service, all of which work had been completed prior to 1889.

The amount expended on the original and modified projects prior to beginning operations on the existing project was $113,599.52, by which the entrance to Little Harbor had been dredged to 10 feet depth, and a direct channel to 9 feet deep had been dredged through the strait where none previously existed; the retaining walls, stone pier, and wooden wharves had also all been built and repaired. The existing project, that of 1895, provides for deepening the channel through the strait to 13 feet at mean low water and widening the same to 300 feet; estimated cost, $396,000.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1902, exclusive of outstanding liabilities, was $40,000, resulting in the removal of all obstructing shoals to a depth of 13 feet at mean low water in the southern half of the channel between its eastern end and the southern branch, known as "Broadway," the greater portion of the shoal at the junction of the two branches, and a shoal in mid-channel just west of this junction.

There is now a fairly good channel of one-half the projected width (150 feet) and 13 feet depth through the strait, but a few small shoal spots west of the junction need to be removed to complete the southern half of the channel.

No work of improvement was in progress during the fiscal year.

Further work will consist in extending the 13-foot depth of channel to the northward until the full width is secured.

The commerce of Woods Hole was about 19,266 tons for 1901, no account being kept of vessels passing through the strait.

For reports on original project, see Annual Report of the Chief of Engineers for 1875, page 272. For reports upon which existing project is based, see annual report for 1893 and for 1895, pages 860 and 750, respectively.

Amount appropriated by river and harbor act approved June 13, 1902..	$20,000.00
July 1, 1902, balance unexpended	20,000.00

(See Appendix D 4.)

4. New Bedford Harbor, Massachusetts.—New Bedford is an estuary of Buzzards Bay, and is the port of the cities of New Bedford and Fairhaven. The mean tidal range is about 4.2 feet.

Before improvement the channel had a depth of 12.5 feet at mean low water. The improvement of this harbor has been carried on under a number of distinct projects, the first being the removal of a wreck and dredging the sand bar formed by it in 1836–1839, on which $17,691.37 was expended. The projects of 1874 and 1877 provided for a channel 300 feet wide and 15 feet deep at mean low water from the deep water just above Palmers Island to the wharves of New Bedford. This work was completed in 1877 at a cost of $20,000.

The project of 1887 provided for a channel 200 feet wide and 18 feet deep from Buzzards Bay to New Bedford, at an estimated cost of $35,000, and has been completed, making a total expenditure of $72,691.37 prior to beginning operations on the existing project.

The existing projects are that of 1895, providing for dredging an anchorage area one-half mile long, 600 feet wide, and 18 feet deep at mean low tide, on the north side of the channel leading from Fairhaven to New Bedford, at an estimated cost of $57,689.33, and that of 1899, providing for a channel 250 feet wide and 18 feet deep at mean low water, from the anchorage basin through the new drawbridge between Fish and Popes islands to the deep water above, at an estimated cost of $34,000.

At the adoption of the existing projects the anchorage area was from 12 to 18 feet deep, and the least depth in the channel between Fish and Popes islands was about 7.3 feet.

The amount expended on the work of the existing projects up to June 30, 1902, exclusive of outstanding liabilities, was $54,009, by which the 18-foot channel 250 feet wide leading from the anchorage basin through the new drawbridge connecting Fish and Popes islands had been completed, and 18.4 acres of the anchorage basin had been dredged.

Eighteen feet of water at mean low tide can now be carried from the main channel through the new drawbridge connecting Fish and Popes islands, but owing to the very soft nature of the material through which the channel was dredged the full width of 18 feet has not been maintained. In order that the projected width may be secured, it is estimated that an expenditure of $10,000 would be required for redredging the western portion of the channel.

The tonnage of this harbor amounted to about 651,602 tons. The effect of the deep water on commerce is the use of deeper draft vessels than formerly, larger cargoes, and a consequent reduction in water freight charges.

The work required to complete the existing project is the completion of the anchorage area and redredging portions of the channel through the drawbridge.

No works of improvement have been in progress during the past fiscal year.

For more extended information, see Annual Reports of the Chief of Engineers for 1875, Part II, page 283; 1888, page 514; 1893, page 816; 1896, page 672; 1897, page 930; 1900, page 1295. Also House Ex. Doc. No. 86, Fiftieth Congress, first session; House Docs. Nos. 59, Fifty-fourth Congress, first session; 146, Fifty-fourth Congress, second session, and 169, Fifty-sixth Congress, first session.

Amount appropriated by river and harbor act approved June 13, 1902 .. $37,700.00
July 1, 1902, balance unexpended 37,700.00

(See Appendix D 5.)

5. Taunton River, Massachusetts.—This river rises in Norfolk County, Mass., and empties into Mount Hope Bay at Fall River.

In its original condition the channel was narrow and obstructed by bowlders, and from Berkley bridge to Taunton the depth was in places not more than 5 feet at mean high water. A vessel of 30 tons burden was as large as could go up to Taunton.

From 1870 to 1879 $63,000 was appropriated to secure 9 feet depth at high water. This work was completed in 1879.

The approved project adopted in 1880 provides for the widening and deepening of the river so as to secure a channel of at least 12 feet depth at high water, with 100 feet width from its mouth up to Berkley bridge (above Dighton); thence 12 feet depth with 80 feet width (100 feet width at bends) up to Briggs Shoal; thence 11 feet depth with 80 feet width up to the shipyard; thence 11 feet depth with 60 feet width up to Weir Bridge, Taunton; all at a total cost estimated in 1893 at $125,000, all of which has been appropriated.

The sum of $188,000 had been expended on this work up to June 30, 1902, by which expenditure all projected work had been practically completed, but the channel had filled up at a few points and needed redredging. About $19,000 of the above amount has been expended in the maintenance of the channel. Vessels of 11 feet draft can reach Taunton at high water, but at some points the 11-foot channel is very narrow. It is estimated that $5,000 every four years will be required to maintain the channel.

The tonnage of 1902 was about 558,050 tons, showing a decrease from previous years.

For more extended information, see Annual Reports of the Chief of Engineers for 1880, page 375; 1884, page 606; 1893, page 824; also House Ex. Doc. No. 86, Fiftieth Congress, first session.

Amount appropriated by river and harbor act approved June 13, 1902 .. $5,000.00
July 1, 1902, balance unexpended 5,000.00

(See Appendix D 6.)

6. Sakonnet River, Rhode Island.—Sakonnet River is an arm of the sea between the island of Rhode Island and the mainland, extending from the ocean to Mount Hope Bay around the head of Rhode Island. It is at present obstructed at its upper end by a causeway extending across it. This causeway has two draw openings, one covered by a draw which is of insufficient width and depth for the needs of commerce, and besides the causeway offers such obstruction to the ebb and flow of the tides that the currents through make the passage dangerous even to boats of such dimensions as could pass through them under ordinary circumstances.

The present approved project provides for increasing the width and depth of the draw opening in the Stone Bridge, owned by the State of Rhode Island, so as to provide an opening 100 feet wide and 25 feet deep at mean low water, estimated to cost $40,000.

No work has been done and no funds expended, owing to the fact that the proposed work involves the total destruction of the present

bridge and existing highway, while no provision is made for rebuilding the bridge or restoring the highway. Until the State of Rhode Island grants the Federal Government the unconditional right to proceed with the work authorized by Congress, and provides either for the restoration or discontinuance of the bridge and highway, the Secretary of War can not proceed with the work. The authorities of the State have been repeatedly advised of the existing complications and of the importance of having the legislature take the proper action to remove them.

The general assembly of the State adjourned without enacting such legislation as was desired by the War Department to enable it to commence this work.

The tonnage of the river for the year 1902 amounted to about 16,100 tons.

July 1, 1901, balance unexpended	$40,000.00
July 1, 1902, balance unexpended	40,000.00

(See Appendix D 7.)

7. *Pawtucket River, Rhode Island.*—This river, otherwise called Seekonk River, is the upper portion of the Providence River and extends from Pawtucket to Providence. Before improvement the channel in the river was narrow and had a ruling depth of about 5 feet at mean low water.

Between 1867 and 1873 $52,000 was appropriated to dredge the channel to 7 feet depth. This work was finished in 1876.

The existing project of 1883 provides for the deepening of the river so as to secure a channel of at least 12 feet depth at low water, with 100 feet width from its mouth, at Providence, up to opposite Grant & Co.'s wharf at Pawtucket, and thence 12 feet depth, with 40 feet width, through a stone ledge for a short distance farther to Pawtucket bridge; all at a total cost estimated in 1883 at $382,500, of which $205,000 was appropriated prior to 1895.

The river and harbor act of March 3, 1899, provided for straightening that portion of the channel between Ten-mile River and Bucklins Island; and the available balance, together with the further funds provided by Congress, will be applied to this work and to deepening the channel at points where it has shoaled.

The sum of $307,519.59 had been expended on this work up to June 30, 1902. The amount expended on the work of the existing project up to June 30, 1902, exclusive of outstanding liabilities, was $255,500, by which a channel had been secured 100 feet in width and 12 feet in depth from the mouth of the river, near Providence, up to the lower wharves of the city of Pawtucket; thence a channel of 40 feet width and 12 feet depth had been completed through the ledge rock to the head of navigation, and the greater portion of the new channel between Ten-mile River and Bucklins Island had been completed. A 12-foot channel is, however, available by the original route.

The mean rise and fall of the tide is about 5 feet.

The effect of the improvement is to cause the use of vessels of deeper draft than formerly, larger cargoes, and cheaper rates. The completed portion of the channel has already been a great benefit to the commerce of the river, which in 1901 amounted to a tonnage of about 216,323.

The work yet to be done is to straighten and deepen the channel in its lower portions, and is an extension of the benefits secured.

For more extended information, see Annual Reports of the Chief of Engineers for 1884, page 608; 1893, page 830; 1895, page 677; 1900, page 1304; also House Doc. No. 113, Fifty-sixth Congress, first session.

Amount appropriated by river and harbor act approved June 13, 1902.. $28,500.00
July 1, 1902, balance unexpended..... 28,500.00

(See Appendix D 8.)

8. Providence River and Narragansett Bay, and removal of Green Jacket Shoal, Rhode Island.—(a) Providence River and Narragansett Bay.—The object of this improvement is to furnish a wide and deep channel for foreign and coastwise commerce from the ocean to Providence.

Before the improvement of the river in 1853 many shoals obstructed navigation, and at one point in the channel, a place called "The Crook" the available low-water depth was but 4.5 feet. Between 1852 and 1873 $59,000 was appropriated to secure first 9 feet and then 12 feet depth of channel. This work was finished in 1873.

The approved project of 1878 as modified in 1882 provides for deepening the river and deepening and widening its anchorage basins so as to secure a channel of at least 25 feet depth at low water with 300 feet width from the deep water of Narragansett Bay up to Providence, R. I., and so as to secure anchorage basins of 20 feet depth with 600 feet width, 18 feet depth with 725 feet width, 12 feet depth with 940 feet width, and 6 feet depth with 1,060 feet width from Fox Point to Field Point, all at a total cost estimated in 1882 at $675,000. This project was completed in 1895.

The total amount expended prior to operations under the existing project was $698,490.60.

The existing project approved in the river and harbor act of June 3, 1896, provided for securing a ship channel 400 feet in width and of a depth of 25 feet at mean low water from Sassafras Point in Providence Harbor, through Providence River and Narragansett Bay by the most direct route practicable to the ocean, by way of the "Western Passage," so called, at an estimated cost of $732,820.

This project, under which work is now in progress, was put under the continuing-contract system.

The amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1902, exclusive of outstanding liabilities, was $368,576.26, by which the channel 300 feet wide and 25 feet deep had been secured to the city of Providence and an anchorage area 1,060 feet wide, with depths varying from 6 to 20 feet, had been dredged, but both the channel and the anchorage area now need some redredging. The new channel 400 feet wide and 25 feet deep had been completed from Sassafras Point down to Conimicut light-house and about three-fourths of the remaining portion had been done.

The mean rise and fall of the tide is about 4.7 feet.

The river and harbor act of June 13, 1902, adopts a new project for an enlarged anchorage area of 25 feet depth, extending the full width of the harbor between Fox Point and the north end of Long Bed and Sassafras Point on the south and including the area known as Green Jacket Shoal. No work has as yet been done under this project.

The available unexpended balance will be applied to continuing the dredging in the new ship channel, which is necessary to render the channel through the "Western Passage" available and beginning the new project for an enlarged anchorage area in Providence Harbor.

The improvement has been of great benefit to commerce, which in 1901 amounted to about 2,866,019 tons.

For more extended information, see Annual Reports of the Chief of Engineers for 1878, page 235; 1882, page 557; 1884, with plan of the works, page 622; 1893, page 830, and for historical data connected with the improvement, 1900, pages 1257 and 1308; also House Doc. No. 108, Fifty-sixth Congress, first session.

(*b*) *Removal of Green Jacket Shoal.*—This shoal is in that part of Providence River which constitutes the harbor of Providence. It lies off the wharves on the south front of the city and occupies a part of the harbor that is required for anchorage purposes, covering an area of about 18 acres between the 15-foot curves and about 30 acres in all. In its original condition the shoal in many places carried only 1 foot of water and was a very troublesome obstruction.

The existing project of 1885 provides for the removal to 25 feet depth at low water of a middle-ground shoal of about 30 acres area in Providence River opposite the city, the portion to be removed to be at least 200 feet distant from the harbor lines of the city, all at a total cost estimated in 1885 at $112,346.

The sum of $104,135.58 had been expended on this work up to June 30, 1902, by which the 23.8 acres out of the original 30 of this shoal had been dredged to 25 feet depth, and a 16-foot depth had been secured over the central and largest portion of the shoal in addition to a 20-foot depth in the main channel, making an important addition to the anchorage facilities of Providence Harbor.

The mean rise and fall of the tide is about 4.7 feet.

In the river and harbor act of June 13, 1902, provision is made for the removal of the remaining portions of this shoal in connection with the project for an enlarged anchorage area in Providence Harbor.

No work was in progress during the year toward removal of this shoal, as no funds were available.

The removal of the shoal will enable vessels to anchor outside of the channel and thus remove an obstruction to vessels going to or from the Providence wharves.

For more extended information see Annual Reports of the Chief of Engineers for 1885, page 598; 1893, pages 830–832; 1900, page 1308; also House Doc. No. 108, Fifty-sixth Congress, first session.

July 1, 1901, balance unexpended	$180,200.54
Amount appropriated by river and harbor act approved June 13, 1902	100,000.00
Amount appropriated by sundry civil act approved June 28, 1902	84,560.00
	364,760.54
June 30, 1902, amount expended during fiscal year	157,020.59
July 1, 1902, balance unexpended	207,739.95
July 1, 1902, outstanding liabilities	29,772.53
July 1, 1902, balance available	177,967.42
July 1, 1902, amount covered by uncompleted contracts	72,656.60

(See Appendixes D 9 and 10.)

9. Fall River Harbor, Massachusetts.—Fall River Harbor lies at the mouth of Taunton River, in the northeastern angle of Mount Hope Bay, which empties into the ocean through Narragansett Bay and Sakonnet River. It forms the port of entry of the city of Fall River, the largest cotton manufacturing city in the United States.

Before improvement the depth of water in the reentrant in the wharf line north of the Old Colony Steamboat Company's wharf was only about 6 feet, and a considerable area of the harbor, especially in front of the upper wharves, carried much less depth of water than existed in its approaches.

The project of 1874 provided for deepening an area in front of the wharves immediately north of the Old Colony Steamboat Company's wharf 160 feet wide to 12 feet and an additional width of 100 feet to 11 feet at mean low tide. This improvement was completed in 1878, at a cost of $30,000.

The existing project, approved by the river and harbor act of March 3, 1899, provides for a channel 300 feet wide and 25 feet deep at mean low tide along the city front between the Old Colony wharf and deep water at the upper end of the city front, at an estimated cost of $58,060.47.

This project was enlarged by the river and harbor act of June 13, 1902, so as to include a channel 25 feet deep and 300 feet wide to connect the deep water in front of the city with the deep water of Narragansett Bay, at a total estimated cost of $175,411.94. Provision is made in this act for placing the work under the continuing-contract system.

The sum of $20,000 had been expended on the existing project up to June 30, 1902, by which the lower reach of the new channel, embracing nearly one-half of the originally projected work, had been completed.

The mean rise and fall of the tide is about 4.7 feet.

No work was done during the past fiscal year.

The work required to complete the existing project is dredging the upper portion of the new channel and dredging the channel across the flats in Mount Hope Bay to connect with the deep water of Narragansett Bay.

The commerce of the port in 1901 amounted to about 3,435,000 tons, and the proposed improvement will give increased facilities for deeper draft vessels.

For more extended information see Annual Reports of the Chief of Engineers for 1874, Part II page 284; 1895, page 272; 1897, page 931; also House Doc. No. 56, Fifty-fifth Congress, first session.

Amount appropriated by river and harbor act approved June 13, 1902..	$38,000.00
July 1, 1902, balance unexpended	38,000.00
Amount (estimated) required for completion of existing project	117,412.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	117,412.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix D 11.)

10. Newport Harbor, Rhode Island.—This harbor is at the main entrance to Narragansett Bay, and all the year it serves as an easily accessible harbor of refuge to foreign and coastwise commerce.

Before improvement the capacity of the inner harbor was limited by shoals, and it was not adequate to the number and size of the vessels seeking it for refuge. The southern or main entrance was obstructed by a bar which stretched out from Goat Island, and the northern entrance by a sharp rocky spit near Rose Island, and the general business wharves of the city could not be reached at low tide by vessels drawing more than 8 feet. The mean tidal range is about 3.75 feet.

Between 1873 and 1875 $28,500 was appropriated to secure 12 feet depth in the harbor. This work was completed in 1876.

The approved project, adopted in 1880, and modified in 1882, 1883, 1884, 1890, and 1895, provides for the widening and deepening of the channel from Narragansett Bay into Newport so as to secure 15 feet depth at low water with at least 750 feet width; for the extension of the 13-foot depth and 10-foot depth anchorage basins, and for dredging a channel 10 feet deep along the State harbor line southward to opposite the gas company's wharf; for the partial cutting off of the shoal spit at the southern end of Goat Island, and for the construction of jetties on the western shore of Goat Island so as to protect the end of this island from erosion and to prevent the drift of sand, etc., around the island into the adjacent parts of the harbor and channel, and for the removal of Spindle Rock, a sharp rocky spit near Rose Island; all at a total cost estimated in 1895 at $206,200.

At the adoption of the existing project this harbor was limited to 12 feet depth at low water, and its anchorage area was too small for the craft seeking harborage at this place during the summer and all the year during storms.

The sum of $195,546.39 had been expended on this work up to June 30, 1902, by which the project had been completed excepting the removal of a few shoal spots in the 13-foot anchorage area.

During the year a shoaling occurred off the wharf of the Fall River Line reducing the depth of water to 13 feet over an area of about 300 square yards. An allotment of $750 from appropriation for "emergencies in river and harbor works" was made for removing the shoal, and this was accomplished by removing 600 cubic yards of gravel and silt. The cost of this work was $340.

After approval of the harbor lines by the Secretary of War on August 28, 1901, the sum of $37.87 allotted from the appropriation "examinations, surveys, and contingencies of rivers and harbors," was expended in placing stone bounds for marking the lines.

The work required to complete the existing project is the clearing up of certain shoal places in the harbor proper, thereby extending the benefits to be derived from work previously done.

As the improvement of this harbor has progressed, there has been a large increase in the size and number of vessels using the harbor. The commerce for 1901 shows a tonnage of about 363,090 tons, principally fish, coal, and general merchandise.

For more extended information, see Annual Reports of the Chief of Engineers for 1873, page 29; 1881, page 562; 1882, page 561; 1883, page 494; 1884, page 624; 1891, page 736, and 1892, page 627.

A plan of the works may be found in the Annual Report of the Chief of Engineers for 1885, page 604, and for 1893, page 838.

August 29, 1901, amount alloted from appropriation for examinations, surveys, and contingencies of rivers and harbors	$50.00
Amount appropriated by river and harbor act approved June 13, 1902	39,000.00
Amount allotted from emergency act of June 6, 1900	750.00
	39,800.00
June 30, 1902, amount expended during fiscal year	[a]50.00
July 1, 1902, balance unexpended	39,750.00
July 1, 1902, outstanding liabilities	340.00
July 1, 1902, balance available	39,410.00

(See Appendix D 12.)

[a] $12.13 returned to United States Treasury.

11. Harbor of refuge at Point Judith, Rhode Island. - Point Judith is the southeastern extremity of South Kingston, R. I., and marks the southwestern entrance to Narragansett Bay. A long ledge, known as Squid Ledge, extends for nearly a mile, in a direction south by east, about 1.5 miles west of the point.

At the adoption of the project this point was a specially dangerous place for boats and tows to pass during storms and even ordinarily bad weather.

The existing project of 1889 provides for the construction at this point of a national harbor of refuge nearly a mile square, by means of stone breakwaters built partly on Squid Ledge and planned so as to give protection against easterly, southerly, and westerly storms, the mainland itself forming a protection on the north, all at a total cost estimated in 1889 at $1,250,000. This project was modified by the report of the Board of Engineers convened to consider and report upon the construction of this harbor, which was approved November 16, 1896, and provided for raising the crest of the eastern arm at an estimated cost of $444,311. A further modification is made by the river and harbor act of June 13, 1902, as follows: "Improving Point Judith Harbor of Refuge, Rhode Island: Continuing improvement, $100,000, of which amount so much as may be necessary may, in the discretion of the Secretary of War, be expended in constructing the easterly detached breakwater and continuing it to the shore with a view to providing a shelter for a landing place." * * *

The sum of $1,246,817.99 had been expended on this work up to June 30, 1902. By this expenditure the breakwater had been built to a total length of 6,970 feet, with a height of 10 feet above mean low water. It incloses an area of about 1 square mile with 12 feet of water, and about 0.92 of a square mile with 18 feet of water, more than two-thirds of which is over 25 feet deep. Three beacon lights had been established and maintained on the breakwater.

During the past fiscal year no operations were in progress, but three small lights were maintained.

The limit of cost of this improvement, as fixed by law, was based on an estimate prepared in 1889 from the best information then available. Experience and additional information gained since that time show that to secure all the beneficial results designed to be accomplished by the breakwater and to properly strengthen and extend it, further appropriations are necessary.

The total amount of the originally estimated cost having been appropriated, an estimate of $444,310.98 was submitted as the additional sum that will be required to strengthen the breakwater and make the necessary additions to it, as recommended by the Board of Engineers in the report of October 23, 1896. (See Annual Report of the Chief of Engineers for 1897, p. 920.)

Three hundred and seventy-six vessels of all classes sought refuge in the protected harbor during the year ending December 31, 1901.

A description of the works may be found in the Annual Report of the Chief of Engineers for 1890, page 595, and for 1893, page 840, and the report of the Board of Engineers in the Annual Report of the Chief of Engineers for 1897, page 920. Also see House Ex. Doc. No. 66, Fifty-first Congress, first session.

July 1, 1901, balance unexpended	$4,887.93
Amount appropriated by river and harbor act approved June 13, 1902	100,000.00
	104,887.93
June 30, 1902, amount expended during fiscal year	1,667.31
July 1, 1902, balance unexpended	103,220.62
July 1, 1902, outstanding liabilities	125.00
July 1, 1902, balance available	103,095.62

(See Appendix D 13.)

12. Entrance to Point Judith Pond, Rhode Island.—Point Judith Pond is a shallow salt pond, lying in the rear of the sandy beach of the Rhode Island shore, just west of Point Judith.

The improvement desired at this place by the people of the neighborhood is widening and deepening the present opening into the pond and the construction of jetties for the maintenance of such opening.

The present entrance to the pond is very shallow (less than 3 feet), crooked and variable in location, and lies about a mile west of the former entrance.

There is at present no approved project for the improvement of the pond entrance.

Up to June 30, 1902, $518.38 had been expended in surveys.

For further information see Annual Report of the Chief of Engineers for 1893, pages 841–879.

July 1, 1901, balance unexpended	$9,481.62
July 1, 1902, balance unexpended	9,481.62

(See Appendix D 14.)

13. Harbor of refuge at Block Island, Rhode Island.—This island is about 14 miles east of the eastern end of Long Island, and about 10 miles distant from the nearest point of the mainland.

The object of the improvement is to furnish a harbor of refuge for medium-draft vessels engaged in foreign and coastwise commerce.

Before the construction of the present harbor, Block Island had no harbor which afforded protection for decked vessels.

The mean tidal range is about 3 feet.

Between 1870 and 1876 $285,000 was appropriated for a breakwater for a harbor for medium-draft vessels, this work being completed in 1878. Between 1880 and 1882 $25,000 was appropriated for dredging an inner basin and the protection of the shore next to the breakwater, this work being completed in 1884. In 1884 $15,000 was appropriated for additions to the old breakwater, this money being so spent and work completed in 1884–85.

The project of 1884, as modified in 1888, provided for the construction of a harbor of refuge on the eastern side of the island, consisting of an enlarged inner harbor (or basin) 800 feet square for small vessels and an exterior harbor for larger ones, at a total cost estimated in 1888 at $75,000. This project was practically completed in 1893.

The total expenditure prior to commencing the work on the existing project was $399,000.

The existing project, that of 1895, provides for raising the entire breakwater to proper height and stopping sand leaks between certain points and dredging the main inner harbor to a depth of 10 feet, at an estimated cost of $83,985.

At the adoption of the present project, this harbor was neither large enough nor well enough protected for the proper harborage of the craft seeking refuge at this place during storms and bad weather.

The sum of $16,790.09 had been expended on the existing project up to June 30, 1902, by which the entrance to the inner harbor, which had shoaled up from the drift of sand through the main breakwater, had been partially dredged to a depth of 12 feet and redredged to a depth of 10 feet several times. The north wall of the enlarged inner harbor had been strengthened and repaired. About $14,000 of the above amount had been expended in maintaining the channel at the entrance to the inner harbor and repairing and strengthening the harbor walls.

During June, 1902, the sand shoal which closed the entrance to the inner harbor was dredged to 10 feet, the funds therefor, amounting to $4,500, being allotted from the appropriation for "emergencies in river and harbor works." Of this allotment, the sum of $52.64 was expended during the past fiscal year.

The appropriation of June 13, 1902, will be applied to repairing the main breakwater, making it sand tight in certain parts, and to dredging the inner harbor.

In 1901 the commerce amounted to about 73,366 tons, an increase over previous years.

For more extended information, see Annual Reports of the Chief of Engineers for 1877, page 202; 1879, page 313; 1880, page 390; 1881, page 563; 1882, page 563; 1884, page 628. A plan of the works may be found in the Annual Reports of the Chief of Engineers for 1885, page 609; 1888, page 506; 1893, page 844; 1896, page 674; also in House Doc. No. 83, Fifty-fourth Congress, first session.

July 1, 1901, balance unexpended	$1,268.92
Amount allotted from emergency act of June 6, 1900	4,500.00
Amount appropriated by river and harbor act approved June 13, 1902	30,000.00
	35,768.92
June 30, 1902, amount expended during fiscal year	559.01
July 1, 1902, balance unexpended	35,209.91
July 1, 1902, outstanding liabilities	2,393.38
July 1, 1902, balance available	32,816.53

(See Appendix D 15.)

14. Great Salt Pond, Block Island, Rhode Island.—The Great Salt Pond is located about the center of Block Island and contains an anchorage area of 150 acres for vessels drawing 18 feet and over. The work of converting the pond into a harbor of refuge by making a channel through the beach on the west, connecting it with deep water in the ocean, was started by the State of Rhode Island and the town of New Shoreham.

The channel under the existing project of 1895, as modified in 1900, is to be 600 feet wide and have a central depth of 25 feet for a width of 150 feet, sloping gradually to 12 feet in a width of 504 feet, the channel seaward to be protected on the south by a jetty extending to 350 feet beyond the original 18-foot contour, and on the north by a jetty about 1,200 feet long, and the sides of the channel where it passed through the original beach to be protected by stone revetments and sand fences, at a total estimated cost of $305,000.

At the time work commenced under the General Government a

channel of varying width and depth had been dredged with the money appropriated by the State and town, which would permit of 12-foot draft being carried in, although there were two 9-foot spots left in mid-channel. The south jetty had been built out 837 feet, and a north jetty 250 feet long had also been built, but at a distance of 720 feet from the south jetty instead of 600 feet, as called for in the adopted project.

Up to June 30, 1902, $90,000 had been expended by the General Government on the existing project, of which $5,253.24 had been used for maintenance and repair. By this expenditure the south jetty had been extended out to the original 18-foot contour and repaired, and an 18-foot channel 300 feet wide with a central cut 25 feet deep and about 35 feet wide had been dredged.

There is at present a channel of 300 feet width and 18 feet depth at low water, with a depth of 25 feet in the center from the ocean into the pond.

There remains to complete the existing project the construction of jetties as planned and dredging to secure the width and depths projected.

For more extended information, see Annual Report of the Chief of Engineers for 1896, page 620; 1900, page 1276; also House Doc. No. 57, Fifty-fourth Congress, first session.

July 1, 1901, balance unexpended	$5,253.24
Amount appropriated by river and harbor act approved June 13, 1902	50,000.00
	55,253.24
June 30, 1902, amount expended during fiscal year	5,253.24
July 1, 1902, balance unexpended	50,000.00

(See Appendix D 16.)

15. Removing sunken vessels or craft obstructing or endangering navigation. Schooners Electa Bailey, John Cullana, Alfred W. Fiske, Douglas Haynes, J. G. Fell, steamer Williamsport, and a dump scow in Newport Harbor.—The *Electa Bailey* was stranded on Hardings Beach, Chatham, Mass.; removal in progress at the close of last fiscal year and completed in October, 1901. The *John Cullana* and *Alfred W. Fiske*, reported sunk on Stone Horse Shoal, off Monomoy light, Cape Cod, in October, 1901, and removal completed in December, 1901. The *Douglas Haynes* was reported sunk 2 miles from Pollock Rip light-ship, December 9, 1901; after diligent search in January, 1902, no trace of the vessel could be found. The *J. G. Fell* was reported sunk November 28, 1901, inside Point Judith Harbor; her removal was commenced in February, 1902, and finished in the same month. The dump scow in Newport Harbor was reported October 2, 1901; the scow was taken out of the harbor and completely destroyed in October, 1901. Steamer *Williamsport* was reported May 12, 1902, sunk 2 miles northeast of Pollock Rip light-ship. Her removal was authorized May 20, 1902, and will be commenced so soon as the wrecking party can be sent.

These wrecks, except as above noted, were completely destroyed during the year, at a cost to the United States of $4,026.05.

(See Appendix D 17.)

IMPROVEMENT OF RIVERS AND HARBORS IN CONNECTICUT, AND OF PAWCATUCK RIVER, RHODE ISLAND AND CONNECTICUT.

This district was in the charge of Maj. Smith S. Leach, Corps of Engineers, to January 7, 1902, and of Maj. Charles F. Powell, Corps of Engineers, since that date, the officer in charge having under his immediate orders Lieut. Edward H. Schulz, Corps of Engineers, to August 23, 1901, and from October 15 to November 5, 1901. Division Engineer, Col. Chas. R. Suter, Corps of Engineers.

1. Pawcatuck River, Rhode Island and Connecticut.—The navigable part of the Pawcatuck River extends 5 miles from the town of Westerly, R. I., to its outlet in Little Narragansett Bay; thence the navigable channel extends through Little Narragansett Bay 2½ miles to Stonington outer harbor, which forms the approach to the bay and river. Little Narragansett Bay is about 1½ miles wide and 2½ miles long, and is separated from the ocean by a sand beach. Its outlet into Stonington Harbor is about three-fifths of a mile wide. Pawcatuck River has a width of about one-third of a mile at its mouth and diminishes to 200 feet at Westerly. Its average width is 1,000 feet.

Before improvement the channel of the river was crooked and obstructed by numerous shoals, on some of which there was but 1½ feet at mean low water, and 4½ feet was the greatest depth that could be carried across the shoals of the bay. The mean tidal oscillation is 2.6 feet at the mouth of the river and 2.3 feet at Westerly.

The original projects, viz, that of 1871, for the river channel only, and that of 1876, for the channel across the bay, provided, respectively, for depths of 5½ and 7 feet at mean low water and for width of 75 and 200 feet. There was expended on original and modified projects prior to operations under existing project $98,000.01.

The present project, approved June 3, 1896, based on the report of the survey ordered in the river and harbor act of August 18, 1894, provides for a channel of 10 feet depth at mean low water from Stonington to Westerly, with a width of 200 feet from Stonington, Conn., to Avondale, R. I., a distance of about 4 miles; a width of 100 feet from Avondale to the lower wharves of Westerly, a distance of about 3 miles, and a width of 40 feet between the upper and lower wharves at Westerly, a distance of about one-half mile, at a total estimated cost of $200,361.60. On this project $29,911.60 has been expended, therewith completing the section 40 feet wide along the wharves at Westerly and extending the 100-foot channel downstream 1,800 feet farther.

Owing to lack of funds nothing in furtherance of the project was done during the past fiscal year.

No work having been done at the lower end under the new project, 7 feet at mean low water was the maximum draft that could be carried from Stonington to Westerly at the close of work, and it is reported that the channel across Little Narragansett Bay has shoaled in places to a depth of 6½ feet since that time.

Table of comparative statistics.

Date.	Vessels of all kinds, each arrival and departure together being counted as one.			Freight tonnage.		
				Received and shipped.	Compared with preceding report.	
	No.	Draft.	Tonnage.		Increase.	Decrease.
		Feet.		*Tons.*	*Tons.*	*Tons.*
1890	1,285	2 to 8	3 to 300	28,667		
1893	2,045	5 to 10	3 to 300	35,968	7,301	
1894	1,774	5 to 10	3 to 300	52,805	16,837	
1895	1,824	2 to 10	3 to 800	43,671		9,134
1896	5,009	2 to 10	3 to 800	39,086		4,585
1897	5,008	2 to 10	3 to 800	46,024	6,938	
1898	4,469	2 to 8	3 to 200	131,602	85,578	
1899	4,405	2 to 8	3 to 200	66,742		64,860
1900	4,290	2 to 8	3 to 200	57,530		9,212
1901				48,313		9,217

The reported value of this commerce for 1900 was $344,813.

July 1, 1901, balance unexpended	$92.78
Amount appropriated by river and harbor act approved June 13, 1902	9,000.00
	9,092.78
June 30, 1902, amount expended during fiscal year	4.38
July 1, 1902, balance unexpended	9,088.40

(See Appendix E 1.)

2. New London Harbor, Connecticut.—New London Harbor comprises the lower 3 miles of the Thames River, having a navigable width of one-quarter to 1¼ miles and depths of 24 feet or more in the main channel from Long Island Sound to the railroad drawbridge which crosses the river above the New London dock front. This channel, especially opposite New London, follows the east bank. Between it and the city docks is a nearly level area having an average depth of 10 to 15 feet. Heretofore vessels of 16 to 18 feet draft have been able at high tide to reach some of the docks. Under a modification of the existing Thames River project, adopted in 1872, Shaws Cove, a branch of New London Harbor, has been dredged to 12 feet.

The project of improvement of New London Harbor, adopted by the act of June 13, 1902, being the first one adopted for this harbor distinct from Thames River improvement, provides for a ship channel 400 feet or more in width, 23 feet deep, and about 6,000 feet long. It is to leave the deep water of the river opposite Fort Trumbull on the west side, skirt the water front of the city, including that of Winthrop Cove, to the Central Vermont Railroad bridge, and join the natural deep channel off the end of the Central Vermont Railroad dock, or at a distance of about 4,000 feet upstream from the point of beginning. The estimated cost of the improvement is $145,000, and $1,000 per annum for maintenance. The tidal oscillation is 2.6 feet. For map see House Doc. No. 392, Fifty-sixth Congress, first session.

The appropriation item authorizes a continuing contract for completion of the work and an examination of the part of Winthrop Cove named, with a view of securing a depth of 30 feet on the lines of the survey on which the authorized improvement project is based.

The tonnage of this port, exclusive of that pertaining to Thames River above New London Harbor, was reported in 1901 as 750,390 tons.

Amount appropriated by river and harbor act approved June 13, 1902...	25,000.00
July 1, 1902, balance unexpended	25,000.00
Amount (estimated) required for completion of existing project	120,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	60,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix E 2.)

3. Thames River, Connecticut.—This river is a tidal stream from Norwich, Conn., the head of navigation, to Long Island Sound, a distance of 15 miles. For 4 miles below Norwich the natural depths were 6 feet or more at low water and width of 400 to 1,000 feet. Below this point depths were 13 feet or more and widths 800 to 3,000 feet.

In 1836 the original project was adopted, providing for a channel 11 feet deep at low water, to be secured by dredging and building dikes. On this project $40,300 had been expended when in 1839 work stopped, the project not having been completed.

The existing project, adopted June 23, 1866, and modified in 1876, 1882, 1888, and 1892, is to dredge and build training walls to secure a channel 200 feet wide with mean low-water depths of 16 feet from New London to Allyn Point and 14 feet thence to Norwich; also to dredge Shaws Cove, to the harbor lines on all sides, a depth of 12 feet at mean low water. Estimate of cost, $457,620 for construction and $8,000 annually for maintenance.

Up to June 30, 1902, there had been expended $408,425.68 on this project and its modifications. Three of the five proposed training walls had been completed and the fourth nearly so. The proposed 16-foot channel had been completed to Allyn Point; thence to Norwich the project depth of 14 feet had been secured in a channel varying in width from 100 to 175 feet. The proposed dredging in Shaws Cove had been completed. The present least depth in the 16-foot channel is about 15½ feet and in the 14-foot channel, where previously dredged, 13 feet; where dredging is required to obtain full project width, 6 feet. Shaws Cove has shoaled to about 9 feet in front of the principal docks. Tidal oscillation averages 2.6 feet at New London and 3.1 feet at Norwich.

Commerce at Norwich and Allyn Point is mainly in coal, lumber, and other building materials, iron, and miscellaneous goods. The work done has reduced the cost of transportation by enabling freight to be brought in vessels of 16 feet draft instead of 8 feet. The river commerce of the present day could not be carried except for the increased depth thus obtained, and urgent requests are now being received for a further increase in channel depths to accommodate the deeper-draft vessels now in use.

Table of comparative statistics.

Date	Vessels of all kinds, each arrival and departure together being counted as one.			Freight tonnage.		
				Received and shipped.	Compared with preceding report.	
	No.	Draft.	Tonnage.		Increase.	Decrease.
		Feet.		*Tons.*	*Tons.*	*Tons.*
1890	810	4 to 16	100 to 1,500	467,144		
1891	219	4 to 16	100 to 1,500	609,568	142,424	
1893	1,906	4 to 16	100 to 1,600	546,900		62,668
1894	1,217	4 to 16	100 to 1,600			
1896	1,844	5 to 19	100 to 1,900	424,945		121,955
1897	1,762	5 to 19	100 to 1,900	574,724		50,221
1898	2,431	5 to 19	100 to 1,900	459,588	84,864	
1900	743	5 to 16	100 to 1,900	464,283		4,695

The reported value of this commerce for 1900 was $2,173,500.

July 1, 1901, balance unexpended	$303.24
Amount appropriated by river and harbor act approved June 13, 1902	15,000.00
	15,303.24
June 30, 1902, amount expended during fiscal year	228.92
July 1, 1902, balance unexpended	15,074.32

(See Appendix E 3.)

4. Connecticut River below Hartford, Conn.—Before the beginning of improvements by the United States the available depth over Saybrook Bar, at the mouth of the river, was 7 feet at mean low water; thence to Hartford the available depth over the shoalest of the river bars was about 5 feet at low water, being generally at its minimum after the spring freshets, and increasing as the period of summer low water continued.

In 1873 a project was adopted for improving the channel at Saybrook Bar, at the mouth of the river, by dredging and by building three jetties at an estimated cost of $336,610. Two of the proposed jetties were completed in 1881, and the third was found to be unnecessary. The amount expended on the project is $23,471.57.

The present project, adopted in 1870, modified in 1887, provides for a channel from Long Island Sound to Hartford, Conn., to be 400 feet wide and 12 feet deep at mean low water across Saybrook Bar, and thence to Hartford, to be 100 feet wide (or as nearly that as practicable) and 9 feet deep at extreme low water, or about 10 feet at ordinary summer low tide, the channels to be maintained by annual dredging in the river and by enlarging the Saybrook jetties and the Hartford dike at an estimated cost—

For annual dredging	$10,000
For permanent work, which includes the dredging at Saybrook Bar (estimated in 1889)	130,000

The total amount expended on this project to close of fiscal year ending June 30, 1902, is $472,622.98.

The maintenance of navigable channels by annual dredging has been held paramount in the project, and is the only work of improvement done upon this river since 1887, the available funds at no time having been sufficient for enlarging the dike or Saybrook jetties or for additional dredging at Saybrook Bar. The jetties and the channel between them are constantly deteriorating and are in a condition demanding attention.

Annual dredging as private work was in progress July 1, 1901; the same was resumed in the spring of 1902 and then prosecuted for a short time. The upstream bar channels had shoaled during freshets and navigation was much impeded. On May 24, 1902, an emergency allotment of $2,000 was made from the appropriation act of June 6, 1900; contract dredging thereunder was begun May 31, 1902, and completed June 21, 1902. Work was resumed June 29, 1902, under the appropriation of June 13, 1902; 18,516 cubic yards was dredged through the upper and lower Hartford, Clay Banks, and Pistol bars, making a channel for immediate use of project depth and 25 feet wide through these controlling places.

Sketches of the Connecticut River from Hartford to Rocky Hill and of Saybrock Bar are printed in the Annual Report of the Chief of Engineers for 1885, page 636. The river from the Sound to Hartford is shown on Coast Survey charts 253, 254, 255, and 256.

Commerce is mainly in coal, stone (shipped from Portland and vicinity), building materials, and miscellaneous freight.

The work done and being done has reduced freights on these articles materially, and without the improvements there could be little commerce on the river.

Table of comparative statistics.

Date.	Vessels of all kinds, each arrival and departure together being counted as one.			Freight tonnage.		
				Received and shipped.	Compared with preceding report.	
	No.	Draft.	Tonnage.		Increase.	Decrease.
		Feet.		*Tons.*	*Tons.*	*Tons.*
1890		7 to 12	100 to 600	1,095,000		
1893	1,200	7 to 12	100 to 1,000	650,000		445,000
1894	1,130	7 to 12	100 to 1,000	560,000		90,000
1895	1,300	7 to 12	100 to 1,600	712,000	152,000	
1896	1,300	6 to 12	100 to 1,600	772,000	60,000	
1897	1,350	6 to 12	100 to 1,600	648,000		124,000
1898	1,350	6 to 12	100 to 1,600	665,000	17,000	
1899	1,400	6 to 12	100 to 1,600	700,000	35,000	
1900	1,400	6 to 12	100 to 1,600	700,000		
1901		6 to 13		733,187	33,187	

GENERAL IMPROVEMENT.

July 1, 1901, balance unexpended	$326.40
Amount appropriated by river and harbor act approved June 13, 1902	30,000.00
	30,326.40
June 30, 1902, amount expended during fiscal year	250.95
July 1, 1902, balance unexpended	30,075.45
July 1, 1902, outstanding liabilities	535.38
July 1, 1902, balance available	29,540.07

MAINTENANCE.

Emergencies in river and harbor works (act of June 6, 1900) for Connecticut River below Hartford, Conn.:	
May 24, 1902, amount allotted	$2,000.00
June 30, 1902, amount expended during fiscal year	132.98
June 30, 1902, outstanding liabilities	1,867.02

(See Appendix E 4.)

5. Harbor of refuge at Duck Island Harbor, Connecticut.—Duck Island Harbor is a bay on the north shore of Long Island Sound. It is about 7 miles west of the mouth of the Connecticut River and midway between the harbors of New Haven and New London. The mean tidal oscillation is 3.8 feet.

The project for this improvement, adopted by the river and harbor act of 1890, provides for the construction of three riprap breakwaters of 3,000, 1,750, and 1,130 feet length, respectively, inclosing and sheltering an area of about 115 acres, with two ample entrances. The adopted height is 6 feet above high water, with crown of 10 feet and slopes of 2 on 3 outside and 1 on 1 inside. The estimated aggregate cost is $463,540. For map see Annual Report of the Chief of Engineers for 1887, page 644.

To June 30, 1902, $114,158.61 had been expended, $202 of which was for maintenance; 2,770 linear feet of the west breakwater had been built, extending westwardly from Duck Island to a low-water depth of 17 feet. No work in furtherance of the project was done during the past year from lack of funds.

Future appropriations will be applied to the construction of the breakwater eastward from Duck Island and in retopping the portion of the west breakwater built in 1898.

The commerce to be benefited by this improvement is the passing commerce of Long Island Sound, which may find it convenient or necessary to seek shelter behind the breakwater during storms. Its value can not be estimated with any accuracy. During the year 1900 1,707 vessels were reported as seeking Duck Island Harbor for refuge.

July 1, 1901, balance unexpended	$93.60
June 30, 1902, amount expended during fiscal year	50.21
July 1, 1902, balance unexpended	43.39

(See Appendix E 5.)

6. Branford Harbor, Connecticut.—This new improvement was authorized by the act of June 13, 1902, which provides for its completion in accordance with report published in House Doc. No. 100, Fifty-sixth Congress, second session, containing project for the development and maintenance by dredging of a channel 100 feet wide and 8.5 feet deep through part of Branford River, upper end of the harbor, between the lower and upper docks, at an estimated first cost of $5,000, and for yearly maintenance of $250. The depth of water across the mouth of the bay, or harbor proper, into which the river empties is about 15 feet, and thence to the river is very uniform at 7.5 feet. The river channel to the lower coal dock is from 7.5 to 9 feet deep, and thence to the upper docks gradually shoals so that the controlling depth there is 3 feet. The rise of tide is 6 feet. The yearly traffic of the harbor, all obtaining at its upper part, was reported in 1900 as 34,120 tons, mainly coal, iron, molding and fire sand, and lumber.

Amount appropriated by river and harbor act approved June 13, 1902	$5,000.00
July 1, 1902, balance unexpended	5,000.00

(See Appendix E 6.)

7. New Haven Harbor, Connecticut.—New Haven Harbor is a bay in the north shore of Long Island Sound, extending about 4 miles inland and from 1 to 2 miles wide. The Mill and Quinnipiac rivers empty into the head of the harbor from the northeast. They are navigable for about 1 and 3 miles, respectively, above their mouths. The mean range of tides is 6.1 feet.

For maps see Annual Report of the Chief of Engineers for 1889, page 678; page 702 of report for 1896; and House Doc. No. 82, Fifty-fifth Congress, first session.

Harbor lines for New Haven Harbor were established by the Secretary of War November 17, 1894, and were slightly modified and amended by him March 2, 1895, May 20, 1895, and May 5, 1900.

The project as adopted, act of March 3, 1899, provides for a main channel 20 feet deep at mean low water, 400 feet wide over the outer bar, and 300 feet thence to Tomlinson's bridge, with three anchorage basins of 20, 16, and 12 feet depth, respectively, at mean low water, to accommodate different classes of shipping.

The act of June 13, 1902, authorizes an extension of the improvement so as to include a certain improvement of the Quinnipiac and Mill rivers to Grand avenue, provided that contracts for the same can be made within limits of cost authorized in the act of March 3, 1899.

At the beginning of the past fiscal year a continuing contract for dredging was in force for completion of the project at the base price of 6 cents per cubic yard. The work was applied to widening the main channel previously dredged under the contract to project depth from the south end of the 16-foot anchorage basin upstream to the deep vessel docks near and below Tomlinson's bridge, and to developing the 12-foot and 16-foot basins. The amount of the year's dredging aggregated 1,006,999 cubic yards, making the total contract and project amount to end of the fiscal year 2,135,069 cubic yards, or about 65 per cent of the estimated yardage of the complete work. Work under the second appropriation for the project, that of act of June 6, 1900, was not finished until January 17, 1902. The contractor had been notified of the availability of this appropriation July 26, 1900. Consequently, and according to the terms of the contract allowing one year for earning the appropriation, 301,701 cubic yards was paid for at the reduced rate of 3 cents per cubic yard.

The amount expended on the work of existing project up to close of the fiscal year ending June 30, 1902, was $114,828.97; the expenditure upon previous projects was $325,695.66.

The improvement during the past fiscal year which has apparently given the greatest benefit is the widening of the turn opposite Long Wharf, where the through channel was formerly sharp and narrow and the space too limited for deep vessels entering the channel to Canal Wharf. The opening of the 12-foot basin has also been of special benefit, as it affords anchorage to a large number of small craft which formerly anchored in or close to the main channel. The increased depths and widths made in the main channel have greatly facilitated the deep-vessel traffic. The net result of the past three years' work is a main channel of navigable width, 20 feet deep from Long Island Sound to Tomlinson's bridge. The mean rise of tide is 6.2 feet. The maximum draft of vessels regularly entering the harbor is about 22 feet.

The commerce of New Haven Harbor is mainly in coal, iron, lumber, miscellaneous merchandise, and oysters.

Table of comparative statistics.

Date.	Vessels of all kinds, each arrival and departure together being counted as one.			Freight tonnage.		
				Received and shipped.	Compared with preceding report.	
	No.	Draft.	Tonnage.		Increase.	Decrease.
		Feet.		*Tons.*	*Tons.*	*Tons.*
1880	18,845	6 to 18	100 to 1,000	2,205,813		
1890	18,025	6 to 20	100 to 1,200	2,980,400	774,587	
1892	29,093	6 to 20	100 to 1,800	3,143,000	162,600	
1894	29,860	6 to 22	100 to 2,500	3,184,000	41,000	
1895	31,400	6 to 22	100 to 2,600	3,295,900	111,900	
1896	28,650	6 to 22	100 to 2,600	3,052,000		243,900
1899	28,693	6 to 22	100 to 2,000	3,440,700	388,700	
1900	28,693	6 to 22	100 to 2,000	3,472,200	31,500	
1901	30,110	6 to 22	100 to 2,600	3,737,049	284,849	

The reported value of this commerce for 1901 was $276,495,163.

July 1, 1901, balance unexpended	$82,257.20
Amount appropriated by sundry civil act approved June 28, 1902	67,000.00
	149,257.20
June 30, 1902, amount expended during fiscal year	46,781.83
July 1, 1902, balance unexpended	102,475.37
July 1, 1902, outstanding liabilities	22,644.48
July 1, 1902, balance available	79,830.89
July 1, 1902, amount covered by uncompleted contracts	69,115.87
Amount (estimated) required for completion of existing project	56,400.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	45,100.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix E 7.)

8. Breakwaters at New Haven, Conn.—The existing and original project for this work, adopted in 1879 and modified in 1890, is to make a harbor of refuge at the entrance to New Haven Harbor by constructing four breakwaters—one extending from Southwest Ledge to Quixes Ledge; one 5,000 feet long, extending from a point 1,000 feet north, 54 degrees east, from Luddington Rock southwesterly across the rock; one about 4,200 feet long, extending northwesterly from a point 6,000 feet south, 54 degrees west from Luddington Rock, and one about 1,200 feet long, extending southwesterly from Morgan Point, on the east side of the harbor entrance. The estimated cost of the whole work from the beginning, in 1879, was $2,151,134.

The anchorage outside of the bar which will be sheltered by this breakwater exceeds 2,000 acres, and has depths of 9 to 26 feet at mean low water.

A sketch of New Haven Harbor, showing the location of the breakwaters as contemplated under the existing project, is printed in the Annual Report of the Chief of Engineers for 1889, page 678, and the last printed sketch may be found in annual report for 1896, page 702.

Up to June 30, 1902, the breakwater from Southwest Ledge to Quixes Ledge had been completed, the Luddington Rock breakwater had been made 4,500 feet long, and 1,490 feet of the west breakwater had been built. The total expenditure to this date had been $834,434.61.

No work of construction was conducted during the past fiscal year, from want of sufficient funds to warrant resumption of operations. A light was maintained at the unfinished end of the west breakwater.

The commerce to be benefited by this work is mainly the passing commerce of Long Island Sound. The projected breakwaters would also provide an outer anchorage for vessels bound to and from New Haven and help protect the entrance to New Haven Harbor proper by seas and to diminish channel filling. For nine months of calendar year 1901 32,283 vessels were reported as passing the breakwaters, the number passing during dark nights or fogs not being observed. The number of round trips of vessels at New Haven for calendar year 1901 was 30,110.

The project could be readily completed within four years.

July 1, 1901, balance unexpended	$1,260.86
Amount appropriated by river and harbor act approved June 13, 1902	44,000.00
	45,260.86
June 30, 1902, amount expended during fiscal year	695.47
July 1, 1902, balance unexpended	44,565.39

(See Appendix E 8.)

9. Milford Harbor, Connecticut.—This improvement was authorized by act of June 13, 1902, upon a project published in House Doc. No. 280, Fifty-sixth Congress, first session. This comprises dredging for a channel across the bar and through the lower harbor, 100 feet wide and 10 feet deep, with an anchorage basin of the same depth of about 6 acres area on the east side of the channel between the long dike and the harbor line, and for a channel through the upper harbor from Merwin's wharf to the straw-works wharf, 90 feet wide and 6 feet deep at mean low water, at an estimated first cost of $15,000 and for yearly maintenance of $500. The mean rise of tide is about 6.2 feet.

Originally the depth on the bar at the mouth of the harbor was less than 2 feet at mean low water, and in parts of the upper harbor the channel ran nearly bare. Under a project for improvement adopted in 1872 a channel 100 feet wide and 4 feet deep at mean low water was excavated through the bar, and in the upper harbor, of the same depth, 60 feet wide from Merwin's wharf to Town Dock and 40 feet wide thence to the straw-works wharf at the head of the harbor. A series of spur dikes was built to protect Welchs Point from erosion. There were also built two jetties or dikes to maintain the bar channel, one projecting from the shore outside the mouth of Indian River, and the other off Burns Point, detached from shore nearly at right angles to the first, and about 300 feet from its western or outer end. A revised project adopted in 1881 provided for an increase in the depth of the bar channel from 4 to 8 feet at mean low water, the width remaining at 100 feet. In 1891 this project was reported as completed, with the dikes and bar channel in good condition and the channel in the upper harbor somewhat deteriorated. No work has since been done by the United States.

In 1894–95 permits were granted private parties to dredge in this vicinity for materials to be used in oyster culture, conditioned upon the work being done under the supervision of the local engineer and directed to the betterment of navigation. Not more than 85,000 yards was taken out under these permits, and possibly not so much, but a

large quantity was removed. It was taken almost wholly from the bar channel; and a statement is on file that when the last dredging was completed, in July, 1895, there was a clear channel across the bar 12 feet deep at mean low water and nowhere less than 80 feet wide.

Upon the formerly adopted projects $45,500, and for surveys $1,600, were expended. No expenditure has been made upon the existing project up to the close of the fiscal year ending June 30, 1902. The traffic last reported, being for 1899, was 11,765 tons. An additional prospective amount of about 6,000 tons, carried by rail on account of insufficient channel, was then named.

Amount appropriated by river and harbor act approved June 13, 1902 ..	$15,000.00
July 1, 1902, balance unexpended	15,000.00

(See Appendix E 9.)

10. Housatonic River, Connecticut.—The Housatonic is a long, shallow river running southward through Massachusetts and Connecticut, emptying into Long Island Sound just east of Stratford Point, about 15 miles southwest from New Haven. At Derby, 13 miles above its mouth, it receives the discharge of the Naugatuck, a small, rapid river. This point, which has been regarded as the head of navigation, is nearly at the head of tide water. About a mile above there is a dam across the Housatonic River furnishing large water power. For at least 5 miles below Derby the water is always fresh.

The original depth on the worst bars in the river (six in number) was from 3.5 to 4.5 feet at mean low water. There was also a bar across the river's mouth with about 4 feet low-water depth. The mean rise of tide at Derby is 4.2 feet. At the mouth of the river it is about 6.2 feet.

The present project for improvement, originally adopted in 1871, with modifications in 1887 and 1893, proposes making and maintaining a channel 7 feet deep at mean low water from Long Island Sound to the head of navigation, about 13 miles, to be 100 feet wide in the river and 200 feet wide over the bar at the mouth, by dredging, removing Drews Rock, building a jetty at Sow and Pigs Reef, and a small dike at the bend below Stratford, and protecting the channel at the mouth of the river by a breakwater about 5,750 feet long. The estimated cost from the beginning in 1871 is $275,000. Up to close of fiscal year ending June 30, 1902, $219,483.69 had been expended upon the project.

A survey, called for in the river and harbor act of June 3, 1896, was made, report of which is published in House Doc. No. 16, Fifty-fifth Congress, first session, and in the Annual Report of the Chief of Engineers for 1897, page 979.

For maps of the whole navigable part of the river, see Annual Report of the Chief of Engineers for 1882, page 616, and House Doc. No. 16, Fifty-fifth Congress, first session; and of the mouth, Annual Report of the Chief of Engineers for 1886, page 642, and 1887, page 608.

July 1, 1901, the project had been completed except the Stratford dike. The shoal crossings had been restored, substantially, to the project dimensions by dredging; near the upper end the depths prevailing were so near the required ones that work there was not deemed necessary, and the balance in hand was held until increased by future appropriations to a sufficient sum to build the Stratford dike.

The channel has now again shoaled and the breakwater needs repair; the appropriation of the act of June 13, 1902, is to be applied in maintenance.

The commerce is mainly in coal, iron, building materials, oysters, raw materials for manufacture, and miscellaneous freight.

The work done has enabled vessels to enter the lower river in safety, instead of waiting for high tide in an exposed situation outside the mouth of the river, and a large part of the commerce could not have been carried on without the improved channel.

Table of comparative statistics.

Date.	Vessels of all kinds, each arrival and departure together being counted as one.			Freight tonnage.		
				Received and shipped.	Compared with preceding report.	
	No.	Draft.	Tonnage.		Increase.	Decrease.
		Feet.		*Tons.*	*Tons.*	*Tons.*
1890 [a]	15,124	1 to 8	1 to 300	138,800		
1892 [a]	12,215	1 to 8	1 to 400	202,325	63,525	
1893 [a]	12,331	1 to 8	1 to 450	159,830		42,495
1896	1,260	2 to 8	3 to 450	79,647		80,183
1897	1,383	2 to 8	3 to 450	83,200	3,553	
1898 [b]	650	2 to 8	3 to 450	77,000		6,200
1899 [b]		2 to 8	3 to 450	64,712		12,288
1900	2,243	2 to 8½	3 to 450	249,185	[c] 165,985	
1901		2 to 5½	50 to 300	146,105		96,920

[a] Includes oyster industry at mouth of river.
[b] Traffic to Derby and Shelton only.
[c] Compared with report for 1897.

July 1, 1901, balance unexpended	$9,243.01
Amount appropriated by river and harbor act approved June 13, 1902	10,000.00
	19,243.01
June 30, 1902, amount expended during fiscal year	226.70
July 1, 1902, balance unexpended	19,016.31

(See Appendix E 10.)

11. Bridgeport Harbor, Connecticut.—This harbor extends nearly 3 miles inland from the north shore of Long Island Sound, its width of about a mile at the mouth decreasing to 200 feet between the opposite wharves at its upper end. The channel in every part of the harbor is comparatively narrow and is crossed by four drawbridges. Before the first work was done by the United States the depth over the bars near the harbor's mouth was 5 feet at low water and above the bridges from 2 to 5 feet. The mean rise of tide is 6½ feet.

In 1836 Congress appropriated $10,000 for improving this harbor, and again a like amount in 1852. These sums were expended in dredging near the mouth of the harbor, making channels 60 to 100 feet wide and 8 feet deep or more at low tide. The depth did not prove permanent. Under acts of Congress of June 23, 1866, and July 11, 1870, surveys or examinations of the harbor were made, and the report upon the examination under the latter act proposed a plan for improvement by dredging a channel 100 feet wide and 12 feet deep at extreme low water, and protecting the outer channels by a breakwater extending about 3,000 feet from Long Beach, on the east side of the harbor entrance, all at an estimated cost of $124,000. This project was adopted in 1871, when an appropriation was made for beginning work upon it.

In 1875 the dimensions of the proposed channel were modified to make it 12 feet deep at mean low water and from 200 to 300 feet wide up to the lower or Stratford Avenue Bridge. This was accomplished in 1882, and then the project was again modified to include widening the channel between the inner beacon and the Naugatuck dock, a distance of 3,800 feet, to prevent overcrowding the main channel by vessels entering for shelter. The estimated cost was $60,000. This work has been nearly completed.

In compliance with the terms of the river and harbor acts of 1878 and 1888, the project was extended to include a channel 100 feet wide and 9 feet deep to the head of navigation at Berkshire Mills; and again, under the terms of the river and harbor act of 1890, to include a breakwater from The Tongue to the inner beacon. The river and harbor act of 1894 also authorized the expenditure of the appropriation made for deepening the channel at the outer bar, and the project was extended to provide for 15 feet depth at that point.

Under the authority of the river and harbor act of 1894 a survey of the harbor was made and the report, printed in the Annual Report of the Chief of Engineers for 1896, pages 803–805, and also in House Doc. No. 61, Fifty-fourth Congress, first session, contains estimates for extending the 15-foot channel to the lower bridge, making it 300 feet wide up to the inner beacon and 200 feet wide above that beacon, which, with the unfinished work of the then existing project, was estimated to cost $90,000,

The river and harbor act of June 3, 1896, appropriated $28,000 for continuing the improvement in accordance with the modified project, $10,000 of which "shall be expended upon Yellow Mill Pond for constructing a channel 12 feet deep and 200 feet wide from the main channel to the causeway, conditioned upon the construction by the city of Bridgeport of a drawbridge at the causeway upon plans approved by the Secretary of War." The amount expended on the original project and its modifications is $317,848.50.

In the act of March 3, 1899, Congress adopted a further modified project for Bridgeport Harbor, embracing the channels previously known as Bridgeport Harbor, Johnsons Creek, and Black Rock Harbor, all of which are avenues of Bridgeport commerce. The project provides for—

First. The main channel 18 feet deep at mean low water, 300 feet wide from the outer bar to the inner beacon, thence 200 feet wide to the lower or Stratford Avenue Bridge.

Second. Anchorage for deep draft, 18 feet at mean low water, 500 feet wide and 2,000 feet long, adjacent to the main channel on the west and immediately above the inner beacon; for light draft, 12 feet deep at mean low water, 500 feet wide and 1,500 feet long, adjacent to the main channel on the west, between the 18-foot anchorage and Naugatuck wharf, and of the same depth at mean low water adjacent to the main channel on the east, between the steel works point and the lower bridge, extending to the harbor line.

Third. Pequonnock River channel, from the lower bridge to the head of navigation, about 1 mile, 12 feet deep at mean low water and 100 feet wide.

Fourth. Yellow Mill channel, from the main channel to the head of Yellow Mill Cove, about 1 mile, 12 feet deep at mean low water and 100 feet wide.

Fifth. Johnsons River channel, from the main channel to the head of navigation, about three-fourths of a mile, 9 feet deep at mean low water and 100 feet wide.

Sixth. Black Rock channel, from the head of Black Rock Harbor to the junction of Cedar and Burr creeks, thence up each of these creeks to the head of navigation, with lengths, respectively, of 1½ miles and one-half mile, 9 feet deep at mean low water and 100 feet wide.

Seventh. The repair and maintenance of the outer and inner breakwaters of the main channel and the one connecting Fayerweather Island with the mainland as now built, and the construction and maintenance of shore protection on Fayerweather Island to check the shifting of the beach.

An appropriation of $50,000 was made in the act cited and a continuing contract authorized.

Harbor lines for this harbor were established by the Secretary of War July 1, 1893, and modified September 19, 1898.

The last sketch of Bridgeport Harbor in the Annual Report of the Chief of Engineers is printed in the report for 1893, page 940, and a complete map is published in House Doc. No. 61, Fifty-fourth Congress, first session.

The amount expended on the existing project to June 30, 1902, was $43,150.19.

The net results are: A main channel 200 feet wide and 18 feet deep (full project dimensions) from the lower (or Stratford avenue) bridge down to about 1,500 feet below the Naugatuck wharf, thence 100 feet wide and 18 feet deep to the turn inside the inner beacon, where the existing depths are from 15 to 18 feet; the 12-foot channel, 100 feet wide, extending up the Pequonnock River, completed to within about 500 feet of the project length; the 9-foot channel, 100 feet wide, extending up Johnsons River, completed to a point about 700 feet above Pleasure Beach wharf; the partial removal of the point in the Black Rock channel, opposite Fancher's wharf; the completion of the upper 12-foot anchorage basin just below the Stratford Avenue Bridge, and the partial development of the 18-foot anchorage basin. The repair and a 380-foot extension of the east breakwater and the construction of four jetties for shore protection on the west side of Fayerweather Island were also made.

The maximum draft that can be carried through the improved channels at mean low tide is about 15 feet through the main channel to the lower bridge, and 12 feet thence to within about 500 feet of the upper end of the Pequonnock River channel. A maximum draft of 9 feet can be carried up Johnsons River as far as the shipyard and about 7 feet draft from the outer end at Black Rock up through the Cedar Creek channel.

This year's work, by completing the 18-foot channel above the Naugatuck wharf with the 15-foot channel outside of the inner breakwater has made it possible for vessels to enter the harbor when drawing 2 feet more than formerly. This is a great benefit, as previously a vessel drawing over 13 feet could only come in at low tide as far as the inner beacon and was obliged to wait until the tide had risen at least 2 feet before proceeding up the harbor. The removal of the point opposite Fancher's wharf at Black Rock is a great relief, as the channel at that point was extremely narrow and the tide ran so swiftly that it rendered navigation difficult. The construction of the jetties

along the west shore of Fayerweather Island in 1900 has apparently had the desired effect, as this shore line is now in approximately the same position as it was two years ago, the slight change that has taken place being recession; so that it is hoped that after this point has been removed the improvement will be reasonably permanent.

The commerce of this harbor is chiefly in coal, iron, lumber and general merchandise. The mean range of tides is about 6.5 feet, but variations of a foot above and below mean high and low water are not unusual.

Table of comparative statistics.

Date.	Vessels of all kinds, each arrival and departure together being counted as one.			Freight tonnage.		
	No.	Draft.	Tonnage.	Received and shipped.	Compared with preceding report.	
					Increase.	Decrease.
		Feet.		*Tons.*	*Tons.*	*Tons.*
1890	24,273	6 to 18	100 to 1,000	1,314,157	a 297,000	
1892	24,223	6 to 18	100 to 1,000	1,324,190	10,033	
1894	18,572	6 to 18	50 to 1,250	968,659		355,531
1895	19,223	6 to 18	50 to 1,250	1,045,769	77,110	
1896	18,723	6 to 18	50 to 1,250	1,030,451		15,318
1897	18,564	12 to 18	100 to 1,250	1,081,973	51,522	
1898	18,770	12 to 18	100 to 1,250	1,196,563	114,590	
1899	15,991	12 to 18	100 to 1,250	1,014,564		181,999
1900	17,462	12 to 18	100 to 1,250	1,163,960	149,396	
1901	18,526	12 to 18		1,131,822		32,138

a Over 1889.

July 1, 1901, balance unexpended	$113,850.63
June 30, 1902, amount expended during fiscal year	6,849.32
July 1, 1902, balance unexpended	107,001.31
July 1, 1902, outstanding liabilities	4,586.37
July 1, 1902, balance available	102,414.94
July 1, 1902, amount covered by uncompleted contracts	102,414.94

(See Appendix E 11.)

12. Saugatuck River and Westport Harbor, Connecticut.—For description of these localities and statement of work under original project, 1826, and its modifications to about 1871, see Annual Report of the Chief of Engineers, 1901, page 189. The total amount expended for the same is $19,444.

The present project was adopted under the appropriation made in 1892 for beginning work. It was to make a channel 4 feet deep and 60 feet wide up to Westport, at an estimated cost of $10,000. This work was completed in 1896.

The river and harbor act of 1894 ordered a survey of Westport Harbor, which was made. The report of this survey is printed in the Annual Report of the Chief of Engineers for 1896, page 806. It is also printed with map in House Doc. No. 67, Fifty-fourth Congress, first session. It proposes a further improvement to provide for repairing the Cedar Point breakwater, removing a ledge opposite Stony Point, or dredging around it, and removing bowlders from the channel, at a total estimated cost of $8,000. Under the terms of the river and harbor act of 1896, appropriating $3,000 for improving Westport Harbor, Connecticut, the project of 1892 was extended to include this work, and the estimated cost was in consequence increased to $18,000.

A sketch of this river and harbor is printed in the Annual Report of the Chief of Engineers for 1894, page 670.

The total amount expended on this present project up to the close of the fiscal year ending June 30, 1902, was $12,823.30.

The 4-foot channel had been completed to Westport, head of navigation, with width generally of 60 feet, and the Cedar Point breakwater had been repaired and extended.

No work of improvement was conducted during the past fiscal year from lack of funds. Completion of the project requires further removal of bowlders and dredging to full project dimensions at the channel opposite Westport.

The commerce comprises coal, merchandise, and miscellaneous articles. The tonnage for calendar year 1901 was 13,626. There has been a gradual decrease of tonnage since 1897, the amounts reported for the years 1896, 1898, and 1900 being 33,507, 22,550, and 18,700, respectively.

Improvements made have rendered navigation of the river practicable at less than high-tide stages by vessels plying there. The mean rise of tide is about 7 feet.

July 1, 1901, balance unexpended	$526.70
June 30, 1902, amount expended during fiscal year	350.00
July 1, 1902, balance unexpended	176.70

(See Appendix E 12.)

13. Harbors at Norwalk, Five-mile River, Stamford, Southport, and Greenwich, Conn.—(*a*) *Norwalk Harbor.*—For description of this harbor and statement of original project, adopted in 1872, and its modifications, upon all of which $83,000 was expended, see page 191, Annual Report of the Chief of Engineers, 1901. A complete map of the harbor is published in House Doc. No. 50, Fifty-fourth Congress, first session.

The present project was adopted by the river and harbor act of 1896. It is to make a dredged channel to South Norwalk, 10 feet deep and 150 feet wide, to widen two bends at the harbor entrance, and to remove the shoal at Ferrys Point to a depth of 6 feet. The estimated first cost is $77,000, and the estimated yearly expenditure for maintenance of this channel and of the channel above South Norwalk $2,000. The amount expended to June 30, 1902, is $26,939.75; a channel of navigable width and 8 feet depth to South Norwalk and 6 feet depth thence to the Norwalk docks had been secured thereby. No operations were conducted during the past fiscal year from want of funds; by June 30, 1902, the channel had narrowed, especially at turns, and to controlling depths of 7.5 feet. The mean rise of tide is 7.1 feet.

The commerce of the harbor is in coal, oysters, lumber, other building material, and merchandise. The traffic for calendar year 1901 amounted to 150,014 tons, or a decrease of 22,261 tons from the preceding year and an increase of 5,259 tons over the amount reported for 1899. The larger vessels load to 12 feet draft; a line of three freight steamers runs to New York.

(*b*) *Five-mile River Harbor.*—For description of this harbor see page

192, Annual Report Chief of Engineers, 1901. The original and present project of improvement was adopted by the act of August 11, 1888. It provides for an 8-foot dredged channel, 100 feet wide, extending up the harbor from Long Island Sound about 8,000 feet.

No operations were conducted during past fiscal year for want of funds; last work done was June, 1899, when the projected channel had been secured for a distance of about 1,900 feet from its outer end up the harbor, and one of 60 feet wide and 8 feet depth for a further distance of 2,600 feet. The amount expended to June 30, 1902, is $22,441.59. The traffic is mainly in oysters and coal, and for the calendar year 1901 is reported as 28,400 tons, or a decrease of 4,600 tons from that reported for 1900, which was much the largest since beginning of records in 1891. Larger vessels plying to the harbor load to 8 feet; the mean rise of tide is about 7.2 feet.

(*c*) *Stamford Harbor.*—For description of this harbor and statement of original project of improvement and modifications, see page 194, Annual Report of the Chief of Engineers, 1901. The amount expended thereon was $20,000.

The present project, authorized by the river and harbor act of 1892 provides for a dredged channel in the East Branch 9 feet deep and 100 feet wide for 8,535 feet, and thence 50 feet wide for about 1,200 feet, or to the head of the harbor, and a channel 1¼ miles long in the West Branch 7 feet deep and 150 feet wide, with a basin between harbor lines at its head, at an estimated cost of $123,500. The project was modified in connection with establishment of harbor lines in 1900, so as to give increased width at upper end of the East Branch. The amount expended upon this project to June 30, 1902, was $40,395.47, and resulted in completion of the West Branch channel, and for about half width in nearly all of the East Branch.

No work of improvement was done during the past fiscal year from lack of sufficient funds to warrant operations.

The commerce is mainly in coal, building material, and merchandise. Its amount for calendar year 1900 is reported as 266,878 tons, which is larger than for any other year, except for 1896, from beginning of the records in 1890. A freight steamer runs between Stamford and New York. The larger vessels load to 15 feet. The mean rise of tide is 7.4 feet.

(*d*) *Southport Harbor.*—This is substantially a new work, authorized by the act of June 13, 1902. There has been no work done at the harbor by the United States since 1883. For a description of the harbor and statement of its former projects for improvement see report of survey, published in House Doc. No. 112, Fifty-fourth Congress, second session, and in the Annual Report of the Chief of Engineers for 1897, page 986. The new project therein recommended would provide a dredged channel, shown upon the map accompanying the report, 100 feet wide and 6 feet deep at the outer bar and through the lower part of the harbor, at an estimated first cost of $12,500, and repairs to breakwater $200, and for yearly maintenance $300, to be expended biennially. Upon the former projects about $32,000 was expended.

It is expected to apply the allotment of funds which may be made to repairing the breakwater, removing two points of ledge rock in the harbor to a depth of 7 feet, and in dredging the channel to project

dimensions through the outer bar and as far upstream as practicable, under a project based upon the report of survey named above.

The traffic of this port in 1896, when last reported, was 25,145 tons, and consisted of coal, fertilizer, building material, and farm produce. There were then three lines of schooners, consisting of five vessels, and making weekly trips between Southport and New York. A considerable fleet of oyster boats working on neighboring beds used the harbor as a night berth and storm haven.

(*e*) *Greenwich Harbor.*—For description of the harbor see page 197, Annual Report of the Chief of Engineers for 1901. The original and present project of improvement was adopted under the river and harbor act of 1896; it provides for a dredged channel 9 feet deep from the mouth of the harbor to the lower docks and 6 feet deep thence to a causeway at head of the harbor, and of 90 feet width throughout, except that the upper end is to be enlarged for a turning basin, all at an estimated cost of $20,000.

Up to June 30, 1902, $5,530.02 had been expended upon the project; a channel of project depth, 6 feet, but of half width, was dredged from the lower docks to the upper docks, near the upper end of the intended channel, or a distance of about 0.5 mile.

No improvement work was done during the past fiscal year from lack of sufficient funds to warrant operations.

The commerce of Greenwich Harbor is in coal, building material, farm produce, and merchandise, and is estimated as 355,000 tons for calendar year 1901; amounts of the articles are not given separately. A passenger and freight steamer makes daily trips to New York. Larger vessels load to 14 feet. The mean rise of tide is 7.5 feet.

July 1, 1901 balance (received from the separate works)	$2,308.54
Amount appropriated by river and harbor act approved June 13, 1902	44,000.00
	46,308.54
June 30, 1902, amount expended during fiscal year	1,115.37
July 1, 1902, balance unexpended	45,193.17

(See Appendixes E 13–17.)

14. Harbor at Coscob and Mianus River, Connecticut.—For description of this harbor see page 195, Annual Report of the Chief of Engineers for 1901. A sketch of the harbor is printed in the same for 1893, page 958, and one of the lower part of the harbor in the report for 1895, page 882.

The original and present project of improvement was adopted by the river and harbor act of 1892 and modified by the river and harbor act of 1896. The project provides for a dredged channel 1.2 miles long and 6 feet deep, 150 feet wide from its outer end to the railroad bridge, 0.4 mile, and thence 100 feet wide to Mianus, at the head of the harbor; also for a turning basin near the lower end 300 feet by 1,750 feet and 7 feet deep, all at an estimated cost of $54,000. The amount expended upon the existing project to June 30, 1902, is $18,929.69. The channel of project depth and widths has been dredged from its outer end to a point 1,600 feet above the bridge; also one-half of the turning basin has been dredged. No improvement was done during the past fiscal year.

The commerce is mainly in coal, lumber, and oysters. Larger vessels load to 8 feet. The mean rise of tide is 7.5 feet.

July 1, 1901, balance unexpended	$170.31
June 30, 1902, amount expended during fiscal year	100.00
July 1, 1902, balance unexpended	70.31

(See Appendix E 18.)

IMPROVEMENT OF HUDSON RIVER AND HARBORS THEREON, OF HARLEM AND EAST RIVERS, AND OF NEWTOWN CREEK, NEW YORK.

This district was in the charge of Col. S. M. Mansfield, Corps of Engineers.

1. Hudson River, New York.—The portion of this river which is now under improvement is the stretch beginning at the State dam at Troy and extending downstream to Coxsackie, a distance of 28 miles. In its natural condition the channel was narrow and crooked, with a navigable depth of 4 feet between the State dam and Albany, of 7½ feet between Albany and New Baltimore, of 11 feet between New Baltimore and Coxsackie, and of 12 feet or more below Coxsackie.

The original project for improvement, adopted in 1834, modified in 1852 and again in 1866, had for its object the securing of a navigable channel of sufficient width and 9 feet deep between Troy and Albany, and 11 feet deep between Albany and New Baltimore. In carrying out this work $1,667,938 was expended.

The existing project, approved July 13, 1892, and amended March 30, 1899, provides for a 12-foot channel 150 feet wide from the State dam to the foot of Jacob street, Troy; thence gradually increasing in width to 400 feet at the foot of Broadway, Troy; thence 400 feet wide to Coxsackie. The work was estimated to cost $4,343,863.

The amount expended on the work under this project to the close of the fiscal year ending June 30, 1902, was $2,812,057.01, of which $159,650.65 was applied to maintenance of improvement.

This expenditure has resulted in a channel of the following dimensions:

From the State dam to Hoosick street, a width of 50 feet and depth of 5½ feet; thence to Delaware and Hudson Company's bridge at Troy, a width of 100 feet and depth of 10 feet; thence through the draw, a width of 50 feet and depth of 4½ feet; thence to the foot of Broadway, a width of 200 feet and depth of 10½ feet; thence to Albany, a width of 150 feet and depth of 11 feet; thence to Coxsackie, a width of 100 feet and depth of 11 feet; thence through Coxsackie Shoal, a width of 50 feet and depth of 10½ feet.

The maximum draft that could be carried June 30, 1902, at mean low water was 5½ feet from the State dam to the Delaware and Hudson Company's bridge at Troy, and thence 10½ feet to Coxsackie. The range of tides varies from 1.61 feet at the State dam and 2.75 feet at Troy and Albany to 3.69 feet at Coxsackie.

The commerce within the limits of the improvements now in progress, amounting to 5,070,800 tons in 1899, to 4,810,927 tons in 1900, and to 3,123,409 tons in 1901, consists principally of merchandise, grain, lumber, fuel, building materials, and ice. In addition to this local commerce, there is a through commerce of more than 10,000,000 tons annually.

July 1, 1901, balance unexpended	$405,569.90
Amount appropriated by river and harbor act approved June 13, 1902	225,000.00
	630,569.90
June 30, 1902, amount expended during fiscal year	139,120.35
July 1, 1902, balance unexpended	491,449.55
July 1, 1902, outstanding liabilities	50,919.91
July 1, 1902, balance available	440,529.64
July 1, 1902, amount covered by uncompleted contracts	214,051.38

(See Appendix F 1.)

2. Saugerties Harbor, New York.—This harbor, situated within the mouth of Esopus Creek, which empties into the Hudson River on its west shore, about 100 miles above New York City, is navigable for a distance of about three-fourths of a mile. In its natural state the creek had a depth of 7 feet; the entrance, however, was obstructed by a wide shoal, on which there was a depth of but 3 feet.

The original project for improvement, adopted in 1884 and modified in 1887, was to secure a permanent channel 300 feet wide and 8 feet deep, at an estimated cost of $52,000. This project, completed in 1892, involved an expenditure of $42,000, and $15,000 has been expended for maintenance to June 30, 1902.

During the fiscal year $2,150 was spent in repairing the dikes at the entrance.

The existing project, adopted June 13, 1902, provides for a channel 12 feet deep and 300 feet wide from the Hudson River to the steamboat landing at Saugerties.

No expenditure has been made in carrying out this project up to the close of the fiscal year ending June 30, 1902.

The maximum draft that could be carried June 30, 1902, at mean low water was 9 feet. The mean rise and fall of the tide is about 4 feet.

The commerce consists mainly of bluestone, coal, building materials, and general merchandise, and amounted to 50,800 tons in 1899, to 76,673 tons in 1900, and to 67,473 tons in 1901.

In order to secure the full benefit from the improvement, the channel should be extended to within 600 feet of the dam at the head of the harbor and an additional channel made in front of the wharves on the west side of the creek above the steamboat landing. (See pages 1494 and 1495 of the Annual Report of the Chief of Engineers for 1900.)

July 1, 1901, balance unexpended	$2,150.00
Amount appropriated by river and harbor act approved June 13, 1902	20,000.00
	22,150.00
June 30, 1902, amount expended during fiscal year	2,150.00
July 1, 1902, balance unexpended	20,000.00

(See Appendix F 2.)

3. Harbors at Rondout and Peekskill, N. Y.—(a) Rondout.—This harbor is situated at the mouth of Rondout Creek, which is navigable for a distance of 3 miles above its mouth. The creek empties into the Hudson River on its west shore 90 miles above New York City, and is the eastern terminus of the Delaware and Hudson Canal.

In 1871, when the harbor was surveyed, an available depth of 7 feet was found, the result of improvements made by private parties.

The original and existing project for improvement, approved June 10, 1872, provides for a permanent channel 14 feet deep and 100 feet wide, the cost of which was estimated at $172,500.

The amount expended on the work up to the close of the fiscal year ending June 30, 1902, is $119,000, of which $29,000 was applied to maintenance. This expenditure resulted in a channel 14 feet deep and 100 feet wide.

The maximum draft that can be carried June 30, 1902, is 12 feet at mean low water. The mean rise and fall of tide is about 4 feet.

The commerce is mainly in fuel, building material, ice, and general merchandise, and amounted to 1,885,000 tons in 1899, to 1,885,000 tons in 1900, and to 1,485,000 tons in 1901.

No additional work, except for maintenance, is necessary.

(*b*) *Peekskill.*—This harbor is on the eastern shore of the Hudson River, about 45 miles above New York City, and has an area of about 1 square mile. It is obstructed by a flat, 3,500 feet wide, to the 12-foot contour of the river, over which the maximum depth is 5 feet at mean low water. A narrow channel, 6 feet deep, followed the shore line from north to south past the village docks, which enabled steamboats and small craft to carry on business there.

The original and existing project for improvement, approved June 3, 1896, contemplates dredging a channel 100 feet wide and 10 feet deep from deep water in the Hudson on the north, along the inner side of the harbor, to deep water on the south. The work was estimated to cost $50,000.

The amount expended to the close of the fiscal year ending June 30, 1902, is $19,400, none of which was applied to maintenance. This expenditure resulted in the completion of a channel of the contemplated dimensions.

The maximum draft that can be carried to the wharves on June 30, 1902, is 10 feet at mean low water. The range of tides is about 4 feet.

The commerce, consisting of general merchandise, building material, iron ore and products, coal, lumber, and molding sand, amounted to 1,092,455 tons in 1899 and to 1,800,750 tons in 1900. No statistics were furnished for 1901.

The commerce of this harbor has increased to such an extent since the project was adopted that channels of the dimensions first decided on are no longer adequate.

Navigation interests ask that a channel 200 feet wide and 15 feet deep be made along the wharf front and that the connections north and south with the Hudson River have the same depth and a width of 150 feet.

The unappropriated amount of the estimate is $30,000 and can be applied to the proposed extension of the project with the authority of Congress.

July 1, 1901, balance unexpended	$600.00
Amount appropriated by river and harbor act approved June 13, 1902	5,500.00
July 1, 1902, balance unexpended	6,100.00

(See Appendixes F 3 and 4.)

4. Wappinger Creek, New York.—Wappinger Creek, a small stream which empties into the Hudson River on the left bank one-half mile below the village of New Hamburg, N. Y., is navigable from the mouth to Wappinger Falls, a distance of about 2 miles. The natural depth in the channel did not exceed 6 feet, while the width varied from 25 to 75 feet.

The original project for improvement, adopted September 19, 1890, contemplated making a channel 80 feet wide and 8 feet deep from the mouth to the falls, at an estimated cost of $13,000.

The amount expended on this improvement to June 30, 1902, was $13,000, no portion of which was applied to maintenance.

This expenditure resulted in a channel of the contemplated dimensions; also an extension 40 feet wide and 8 feet deep from deep water in the main branch of the creek to the Wappinger town dock. These channels were completed June 30, 1892, since which time no work has been done.

The maximum draft that can be carried June 30, 1902, at mean low water from the mouth to the falls is believed to be 6 feet. The range of tides at the mouth is about 4 feet.

The commerce, consisting principally of cotton goods, clothing, combs, and iron, amounted to 70,000 tons in 1888, since which time no statistics have been compiled.

No additional work, except for maintenance, is necessary.

Amount appropriated by river and harbor act approved June 13, 1902.....	$1,500.00
July 1, 1902, balance unexpended	1,500.00

(See Appendix F 5.)

5. East River and Hell Gate, New York.—East River, a tidal strait separating New York City from Long Island, extends from the Battery to Throgs Neck, a distance of about 16 miles. In its natural condition it was obstructed by rocks and reefs, especially in the part known as Hell Gate.

The improvement of this waterway was commenced in 1852 under a project prepared in 1848, which contemplated the removal of rocks at Hell Gate and Diamond Reef.

The amount expended under this project was $33,861.59.

The existing project for improvement, adopted in 1868 and modified in 1870, 1874, 1884, 1889, 1890, and 1899, provides for the removal of rocky obstructions from the channel between the Battery and Baretto Point to depths varying from 18 to 26 feet, and for the construction of sea walls and dikes where necessary to guide the tidal currents.

The cost of the work was estimated at $5,639,120.

The amount expended in carrying out this project to the close of the fiscal year ending June 30, 1902, was $4,595,088.30, no portion of which was applied to maintenance.

This expenditure has resulted in the removal to the contemplated depth of Diamond Reef, reef off Diamond Reef, Coenties Reef, Charlotte Rock, Hallets Point, Ways Reef, Shell Drake, Scaly Rock, reef at Middle Ground, off Sunken Meadow, North Brother Island Reef, and reef off Baretto Point; in the practical removal of the Twenty-sixth street reef and Man-o'-War Rock, and in the partial removal of Battery Reef, reef off South Ferry slips, Third street reef,

Shell Reef, Pilgrim Rock, Ferry Reef, off Thirty-fourth street, Middle Reef, including Flood Rock, Gridiron, Hen and Chickens, and Negro Heads, Frying Pan, and Pot Rock.

A maximum draft of 26 feet at mean low water could be carried June 30, 1902, through the main channel of the river from the Battery to Long Island Sound. The following are the least depths at localities where improvement has not been completed:

Localities.	Least depth June 30, 1902.
Battery Reef	19
Reef off South Ferry slips	19
Reef off Third street	15.9
Shell Reef off Ninth street	15
Pilgrim Rock off Nineteenth street	24
Ferry Reef off Thirty-fourth street	24
Middle Reef	18.3
Heel Tap	20.5
Frying Pan	18
Pot Rock	22.3

The range of tide south of Hell Gate is from 4½ to 5 feet, and east of it from 5 to 7 feet.

The traffic on East River is of very great extent and is intimately connected with that of New York Harbor proper. It is impracticable to obtain reliable statistics to show what proportion properly belongs to the East River, especially as the heavy coastwise traffic passing through this waterway is carried on in vessels which do not enter or clear at the custom-house.

July 1, 1901, balance unexpended	$142,472.99
Amount appropriated by river and harbor act approved June 13, 1902	100,000.00
	242,472.99
June 30, 1902, amount expended during fiscal year	104,219.84
July 1, 1902, balance unexpended	138,253.15
July 1, 1902, outstanding liabilities	30,667.46
July, 1, 1902, balance available	107,585.69
July 1, 1902, amount covered by uncompleted contracts	6,595.87

(See Appendix F 6.)

6. Harlem River, New York.—The Harlem River and Spuyten Duyvil Creek, both included in the improvement, are two waterways which join at Kingsbridge, N. Y., and separate Manhattan Island from the mainland. The narrow channel at their junction was obstructed by a ledge of rocks, awash at low tide.

Before improvement the Harlem River had an available depth of 10 feet from the East River to Morris dock, except at Highbridge, where it was only 6 feet. From Morris dock to Fordham Landing there was a crooked channel 7 feet deep, and above the latter place the river could be used only by the smallest class of vessels.

Spuyten Duyvil Creek, from Kingsbridge to the Hudson, had a depth of 4 feet.

The original project for improvement, adopted in 1874, provided for the removal of old bridge piers, Candle Factory Reef, and bowlders at various places near the East River to a depth of 12 feet, the cost of the work being estimated at $167,875.56. In furtherance of this project $21,000 was expended.

The existing project, adopted June 18, 1878, and modified October

7, 1886, provides for a continuous channel 400 feet wide and 15 feet deep from the East River to the Hudson River, except just north of Highbridge, where the width was made 375 feet, and the rock cut through Dyckman meadow, where the width was reduced to 350 feet and the depth increased to 18 feet. The cost of the work was estimated at $2,700,000.

The amount expended in carrying on work under the existing project to the close of the fiscal year ending June 30, 1902, was $1,243,702.78, none of which was applied to maintenance.

This expenditure has afforded a channel from the East River to the Hudson River, having nowhere a less width than 100 feet or less depth than 12 feet.

The maximum draft that could be carried June 30, 1902, at mean low water was 12 feet. The range of tide in the Harlem River varies from about 4 feet in the western to about 5½ feet in the eastern section.

The commerce of the river, which is very large and steadily increasing, consists mainly of general merchandise, grain, flour, feed, lumber, building materials, coal, ice, etc.

It was impracticable to obtain complete returns for the calendar year 1901. The last reliable information received was for the year 1895, when the tonnage amounted to over 7,500,000 tons.

July 1, 1901, balance unexpended	$3,339.64
Amount appropriated by river and harbor act approved June 13, 1902	75,000.00
	78,339.64
June 30, 1902, amount expended during fiscal year	2,042.42
July 1, 1902, balance unexpended	76,297.22

(See Appendix F 7.)

7. *Newtown Creek, New York.*—This creek, an inlet of the East River, extending inland between Kings and Queens counties, N. Y., for a distance of about 4 miles, had a natural depth varying from 12½ feet at the mouth to 4 feet at the head of navigation.

The original project, adopted in 1880 and modified in 1884, provided for a channel 240 wide and 21 feet deep from the mouth to the Vernon Avenue Bridge, thence to the head of navigation on both branches for channels decreasing from 175 to 100 feet in width and from 18 to 10 feet in depth. The cost of the work was estimated at $255,500. In carrying out this project $197,500 was expended.

The existing project, adopted June 3, 1896, is to secure a uniform channel 125 feet wide and 18 feet deep from the East River to the head of navigation at Metropolitan avenue, at an estimated cost of $450,000, and subsequently reduced to $213,000.

The amount expended in carrying out this project up to the close of the fiscal year ending June 30, 1902, was $197,714.39, none of which had been spent for maintenance.

This expenditure has resulted in a practical completion of the project, as a channel of the proposed dimensions has been secured.

The maximum draft that can be carried June 30, 1902, at mean low water is 18 feet. The range of the tide amounts to about 4½ feet.

The quantity of freight handled on the creek amounts to at least 3,000,000 tons annually, and consists mainly of coal, building materials, oil, chemicals, etc.

Dredging for maintenance will be necessary from time to time.

July 1, 1901, balance unexpended	$15,685.61
June 30, 1902, amount expended during fiscal year	400.00
July 1, 1902, balance unexpended	15,285.61
July 1, 1902, outstanding liabilities	335.00
July 1, 1902, balance available	14,950.61

(See Appendix F 8.)

8. Harbor at Echo Bay, New York.—The original project for improvement, adopted in 1875, provided for the removal of two ledges, known as Start Rock and Sheepshead Reef, to 7 and 9 feet depth, respectively, at an estimated cost of $38,955.38.

Prior to 1902 the sum of $22,000 had been appropriated, with which Start Rock was wholly, and Sheepshead Reef partly, removed to the projected depths and a channel 40 feet wide and 4 feet deep at mean low water dredged from Beauford Point to within 300 feet of the head of the harbor.

The project adopted by the river and harbor act of June 13, 1902, contemplates completion of the original plan by the removal of the remainder of Sheepshead Reef and Start Rock, at an estimated cost of $17,000.

The present project is printed in House Doc. No. 235, Fifty-sixth Congress, first session, and in the Annual Report of the Chief of Engineers for 1900, page 1429.

Amount appropriated by river and harbor act approved June 13, 1902	$10,000.00
July 1, 1902, balance unexpended	10,000.00

IMPROVEMENT OF NEW YORK HARBOR, OF BAY RIDGE, RED HOOK, AND BUTTERMILK CHANNELS, AND OF GOWANUS CREEK CHANNEL, NEW YORK; ENLARGEMENT OF GOVERNORS ISLAND.

This district was in the charge of Maj. W. L. Marshall, Corps of Engineers, having under his immediate orders Lieut. William L. Guthrie, Corps of Engineers, since March 10, 1902. Division Engineer, Col. Chas. R. Suter, Corps of Engineers, to July 24, 1901, and Col. S. M. Mansfield, Corps of Engineers, since that date.

1. New York Harbor, New York.—Before the improvement of the main entrance into New York Harbor was undertaken by the United States the least depth in mid-channel on the outer bar was 23.7 feet at mean low water, and about the same across three other shoals between the bar and deep water in the harbor. A large proportion of the commerce of the port, carried in vessels of great draft, could cross these shoals only at or near high water.

The project for the improvement of Gedney Channel was approved by the Secretary of War December, 1884, and extended to cover the whole of the main entrance to the harbor December, 1886. It provided for dredging a channel 1,000 feet wide and 30 feet deep at mean low water from deep water below the Narrows through the Main Ship and Gedney channels to deep water outside the bar. The estimated cost was $1,490,000 for dredging 4,300,000 cubic yards. The actual amount dredged to October, 1891, when the work was approximately completed, was 4,875,079 cubic yards.

The existing project, for maintenance of channels, was approved November 15, 1892. The estimated cost of this work varies in different years; it is estimated at $50,000 annually.

Under this project the amount expended up to July 1, 1902, is $1,920,911.16.

As a result of these expenditures the channels to the sea have been maintained with a navigable depth of 30 feet at mean low water and with width of 1,000 feet.

June 30, 1902, these channels are navigable at mean low water by ships drawing 30 feet. The mean rise of tide is 4½ feet.

Under the terms of the river and harbor act of 1899 a project was adopted for making an entrance to New York Harbor by way of Ambrose Channel (formerly known as East Channel) to be 2,000 feet wide and 40 feet deep at mean low water; the work was authorized to be done under a continuing contract at a cost not exceeding $4,000,000. It involves excavation of a channel about 7 miles in length.

The original depth through this channel was 16 feet at mean low water, the shoalest part being the outer bar. The channel was used only by towboats, scows, and other light-draft vessels.

Under the existing project, up to July 1, 1902, $402,436.38 has been expended in excavating for about a mile in length on the outer bar.

No result useful to navigation will be obtained until the cuts are carried through the outer bar, which is about 2 miles long; the available depth, June 30, 1902, is about 16 feet at mean low water on the shoal not yet dredged.

The foreign exports and imports for the port of New York during the year ending June 30, 1901, amounted approximately to 10,500,000 tons, valued at $1,188,227,632, being an increase over the valuation in 1886, before the improvement was begun, of $347,950,940. The entire cost of improvement of New York Harbor up to date is less than three-quarters of 1 per cent of the increase in annual value of foreign commerce of the port since the improvement began, and is less than one quarter of 1 per cent of the value of the present foreign commerce per year.

No statistics are kept of the local and coastwise domestic commerce.

Further details of the harbor and improvements are printed in the Annual Report of the Chief of Engineers for 1897, page 1031.

A report on survey of Ambrose (East) Channel, with map, was printed in House Doc. No. 243, Fifty-fourth Congress, second session (see Annual Report of the Chief of Engineers for 1897, p. 1053).

GENERAL IMPROVEMENT.

July 1, 1901, balance unexpended	$15,828.90
Amount appropriated by river and harbor act approved June 13, 1902	50,000.00
	65,828.90
June 30, 1902, amount expended during fiscal year	13,715.54
July 1, 1902, balance unexpended	52,113.36
July 1, 1902, outstanding liabilities	181.93
July 1, 1902, balance available	51,931.43

AMBROSE CHANNEL.

July 1, 1901, balance unexpended		$1,096,630.79
Amount appropriated by sundry civil act approved June 28, 1902		150,000.00
		1,246,630.79
June 30, 1902, amount expended during fiscal year	$368,767.17	
June 30, 1902, amount withdrawn, expenses Office Chief of Engineers	1,300.00	
		370,067.17
July 1, 1902, balance unexpended		876,563.62
July 1, 1902, outstanding liabilities		45,408.42
July 1, 1902, balance available		831,155.20
July 1, 1902, amount covered by uncompleted contracts		2,420,034.28
Amount (estimated) required for completion of existing project		2,720,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902		340,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

(See Appendix G 1.)

2. Channel in Gowanus Bay: Bay Ridge and Red Hook channels, in the harbor of New York.—These channels lie along the east shore of the Upper Bay, New York Harbor, and with Buttermilk channel form an easterly channel between the Narrows and East River, separated from the main channel by a broad shoal off Gowanus Bay and by Governors Island.

Bay Ridge and Red Hook channels had a natural low-water depth of 7 to 12 feet, and were available only for a limited harbor commerce.

The original project, adopted in 1881, provided for making these channels 18 feet deep and 200 feet wide, subsequently modified to make the depth 26 feet with width of 800 feet in Bay Ridge Channel and 400 feet in Red Hook Channel. This was completed in 1899, at a cost of about $1,090,000.

The existing project was adopted by the terms of the river and harbor act of 1899, which provided for making Bay Ridge and Red Hook channels 40 feet deep at mean low water and 1,200 feet wide. The work was authorized to be done under a continuing contract, at a cost not exceeding $2,500,000.

Under this project, up to July 1, 1902, $185,723.52 has been expended. About 10 per cent of the area to be dredged has been deepened. The work is not far enough advanced yet to be of any general benefit to the channels, and the maximum available depth June 30, 1902, is 26 feet at mean low water.

The mean rise of tide is 4.5 feet.

The commerce of this part of New York Harbor consists of coal, lumber, iron, and miscellaneous freight, amounting in 1899 to 3,294,825 tons, valued at $106,324,148. It is believed to be increasing. The amount of commerce in transit through these channels can not be estimated with any accuracy. A recently established New York-Hawaiian steamship line has its terminus in Bay Ridge Channel.

The additional work proposed and authorized under the existing continuing contract is necessary to make the work so far done available for navigation.

Further details of these channels are contained in the Annual Report of the Chief of Engineers for 1899, page 1266.

House Doc. No. 337, Fifty-fourth Congress, second session, contains a report upon a survey of these channels, with map showing location and depths as existing in 1897 (see Annual Report of the Chief of Engineers for 1897, p. 1177).

July 1, 1901, balance unexpended		$489,215.10
Amount appropriated by sundry civil act approved June 28, 1902		100,000.00
		589,215.10
June 30, 1902, amount expended during fiscal year	$172,038.62	
June 30, 1902, amount withdrawn, expenses Office Chief of Engineers	900.00	
		172,938.62
July 1, 1902, balance unexpended		416,276.48
July 1, 1902, outstanding liabilities		61,723.78
July 1, 1902, balance available		354,552.70
July 1, 1902, amount covered by uncompleted contracts		1,947,747.60
Amount (estimated) required for completion of existing project		1,898,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902		348,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix G 2.)

3. Buttermilk Channel, New York Harbor.—This channel, lying between Governors Island and the Brooklyn shore, forms an easterly channel from East River to the main channel and to Red Hook Channel.

Prior to improvement it had a natural depth of 26 feet in a channel so narrow and crooked as to be hardly navigable. Its available depth for navigation was about 20 feet.

The first project for improvement, adopted in 1880, provided for the removal of part of one shoal to widen the channel. This was subsequently extended to removal of both shoals to 26 feet depth, making the channel about 1,000 feet wide. The work was completed in 1899, at a cost of about $650,000.

The existing project, adopted by the river and harbor act of 1902, provides for deepening the channel to 30 feet at mean low water, with such width as the appropriation of $90,000 will suffice for, estimated at about 400 feet.

No money has been expended and no results obtained under the existing project up to June 30, 1902. The available depth is 26 feet at mean low water, with mean rise of tide of 4.5 feet.

The commerce of Buttermilk Channel in 1899 amounted to 16,587,000 tons, valued at $658,384,823. It is believed to be about the same now as then.

The work proposed under the existing project is to increase the available depth.

A survey of Buttermilk Channel was made in 1900. The report containing further details is printed, with map, in House Doc. No. 122, Fifty-sixth Congress, second session (see Annual Report of the Chief of Engineers for 1901, p. 1299).

Amount appropriated by river and harbor act approved June 13, 1902	$90,000.00
July 1, 1902, balance unexpended	90,000.00

(See Appendix G 3.)

4. Gowanus Creek channel, New York Harbor.—That part of Gowanus Creek improved under the title of Gowanus Creek channel is the part from the foot of Percival street on the east to the junction of Red Hook and Bay Ridge channels on the west.

Before improvement Gowanus Creek channel had an available low-water depth of 11 feet, which was sufficient at that time, because the channels of approach in Gowanus Bay had no greater depth.

The first project for improvement, adopted in 1881 and subsequently modified, provided for making a depth of 21 feet at mean low water in the Gowanus Creek channel, with width extending to the harbor lines on either side. This was accomplished in 1893, under parts of appropriations made for the several channels, of which it is estimated that about $75,000 was applied to Gowanus Creek channel.

The existing project, adopted in 1896, provides for making the channel 26 feet deep at mean low water, at a total estimated cost of $70,000.

Up to July 1, 1902, $50,000 had been expended upon this project.

No expenditures were made during the past fiscal year.

The channel has been made 26 feet deep at mean low water for the full length and nearly the projected width; it has shoaled somewhat where first dredged, but it is still available for 26 feet draft on either side of the middle.

The mean rise of tide is 4.5 feet.

The commerce received in Gowanus Creek consists of coal, lumber, building materials, and miscellaneous goods, amounting to about 237,300 tons of freight in 1899, valued at $3,048,390. In addition, 2,041,980 tons of freight passed through Gowanus Creek channel to and from Gowanus Canal, valued at about $20,000,000, making a total tonnage of 2,279,280 tons. The annual value of this commerce is about three hundred times the total cost of the present project.

The additional work proposed, with available funds, will complete the project, extending the improvement to the full width of the channel and removing shoals.

Amount appropriated by river and harbor act approved June 13, 1902...	$20,000.00
July 1, 1902, balance unexpended	20,000.00

(See Appendix G 4.)

5. Enlargement of Governors Island, New York Harbor.—The project for this entire work, adopted under the terms of the sundry civil act of 1901, which made appropriations for beginning operations, includes an addition of about 82 acres to the area of the island, by inclosing with a bulkhead part of the shoal southwest of the island and filling the inclosure, the building of a wharf on the north shore, and dredging to a depth of 26 feet in front of the wharf, and the erection of buildings. The work of enlargement, including construction of a wharf and dredging, all estimated to cost $885,000, was assigned to the Engineer Department.

Work was begun in August, 1901.

Up to July 1, 1902, 2,430 linear feet of riprap substructure for the bulkhead had been completed and 750 feet additional is in progress; a wharf with T-head 370 feet long and 50 feet wide has been completed, except a few of the minor details, and is in daily use; the approaches to the wharf have been dredged to 26 feet depth at mean low water,

under a contract nearly completed; a small landing near Castle Williams was filled in and extended, and the approach to it was dredged to 15 feet depth.

The available funds will complete the riprap part of the bulkhead up to Castle Williams wall, an additional distance of about 1,500 feet.

Future appropriations will be applied to continuing and completing the enlargement.

July 1, 1901, balance unexpended	$200,000.00
Amount appropriated by general deficiency act approved July 1, 1902	200,000.00
	400,000.00
June 30, 1902, amount expended during fiscal year	109,493.99
July 1, 1902, balance unexpended	290,506.01
July 1, 1902, outstanding liabilities	29,659.20
July 1, 1902, balance available	260,846.81
July 1, 1902, amount covered by uncompleted contracts	26,822.90
Amount (estimated) required for completion of existing project	625,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	400,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix G 5.)

6. Removing sunken vessels or craft obstructing or endangering navigation.—(*a*) A lighter, name unknown, was found sunk on the edge of Red Hook Channel, New York Harbor, with a least depth upon it of 8 feet at low water. It was removed in January, 1902, and grounded back of the bulkhead line at Edgewater, N. J.

(*b*) The coal barges *Lichtenfels Bros.*, *Ringleader*, and *P. J. Carleton*, each with a cargo of about 1,500 tons of soft coal, were sunk in February and March, 1902, the first named on the west side of Main Ship Channel, and the others on the east side, in about 20 to 25 feet of water, in the fairway of sailing vessels.

Contracts for their removal were made, and the *Lichtenfels Bros.* and the *Ringleader* have been removed, but not yet finally disposed of. Removal of the *P. J. Carleton* is in progress.

(*c*) The schooner *Jacob Rivell*, with cargo of brick, ran into the Governors Island bulkhead, New York Harbor, during a thick snow squall in March, 1902. She sunk and lay in about 20 feet of water, with her masts above the surface. The wreck was abandoned, and was removed in May, 1902, and grounded at high water behind the bulkhead line at Weehawken, N. J.

(See Appendix G 6.)

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN NEW YORK TRIBUTARY TO LONG ISLAND SOUND, ON THE SOUTHERN SHORE OF LONG ISLAND AND IN NORTHERN NEW JERSEY; DELAWARE RIVER, AND WORKS OF IMPROVEMENT IN DELAWARE BAY.

This district was in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, to October 1, 1901, having under his immediate orders Capt. Spencer Cosby, Corps of Engineers, to September 4, 1901; in the charge of Col. Jared A. Smith, Corps of Engineers, from October 1, 1901, to June 2, 1902, and in the temporary charge of Captain Cosby since June 2, 1902.

1. Port Chester Harbor, New York.—[This work was in the charge of Col. S. M. Mansfield, Corps of Engineers, to January 31, 1902, and in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, from January 31 to June 12, 1902.] This harbor, situated at the boundary between the States of New York and Connecticut, consists of the tidal part of Byram River and of a bay at its mouth opening into Long Island Sound.

The depth in the river before improvement was 1 foot; and Salt Rock, in the river, and Sunken Rock, in the bay, were considered to be dangerous obstructions.

The original project for this improvement was adopted in 1872 and modified in 1884 and 1888. It proposed to remove Salt Rock to 9 feet below mean low water, to build a breakwater from Sunken Rock to Byram Point, and to dredge and maintain a channel to the Port Chester wharves, at a total cost of $57,000. Up to 1899, at a total cost of $52,000, this project has been completed, except the dredging in the upper harbor.

The existing project, approved March 3, 1899, provides for a channel 12 feet deep and 70 feet wide from deep water in the bay up to the town wharf, and thence 9 feet deep and 60 feet wide to the steamboat wharf, the work to be done by dredging and rock removal. Estimated cost, $25,000.

Up to June 30, 1902, $22,859.71 had been expended on present project.

No work in furtherance of the project has been done during the year, as the available funds were insufficient.

The work done under the present project has resulted in the completion of a channel of the proposed depth and width, except at and opposite the southerly point of Fox Island, where the width is only about 60 feet.

The maximum draft that could be carried June 30, 1902, at mean low water over the shoalest part of the channel was about 12 feet up to the town wharf, and thence about 9 feet to the steamboat wharf, and above the steamboat wharf 2½ feet. Mean range of tides, 7.4 feet.

The commerce of this harbor, mainly in coal, building materials, manufactured goods, and farm produce, amounted to 140,000 tons in 1898, to 169,500 tons in 1899, to 181,000 tons in 1900, and to 327,500 tons in 1901.

The additional work proposed is necessary for completing the channel by widening it, and for maintenance. Detailed description of this improvement is printed in the Annual Report of the Chief of Engineers for 1897, pages 1084 and 1085. Sketches of the river and harbor are printed in the annual reports for 1885, page 658, and for 1889, page 716.

July 1, 1901, balance unexpended	$2,140.29
Amount appropriated by river and harbor act approved June 13, 1902	5,000.00
July 1, 1902, balance unexpended	7,140.29

(See Appendix H 1.)

2. Mamaroneck Harbor, New York.—[This work was in the charge of Col. S. M. Mansfield, Corps of Engineers, to January 31, 1902, and in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, from January 31 to June 12, 1902.] This harbor, situated on the north

shore of Long Island Sound, consists of a narrow inlet opening into a shallow, broad bay.

Before improvement the channel to the old steamboat wharf, half a mile up the inlet, had a depth of 5 feet at mean low water, gradually decreasing to 1 foot at the upper wharves. Various rocks at or near the mouth of the inlet obstructed navigation.

The present project for improvement, approved August 2, 1882, and modified April 27, 1899, provides for the removal of Round Rock to 4 feet depth and Bush Rock and Inner Steamboat Rock to 7 feet depth, and for making a channel 7 feet deep and 100 feet wide from the harbor entrance to the upper wharves. Estimated cost, $43,000.

Up to June 30, 1902, $31,960.40 had been expended in carrying out the work.

No work was done during the past fiscal year, sufficient funds not being available.

The condition of the improvement remains about the same as stated in Annual Report of the Chief of Engineers for 1900, page 1382.

The maximum draft that could be carried June 30, 1902, over the shoalest part of the channel at mean low water was 7 feet. Mean range of tides, 8 feet.

The commerce of the harbor, in coal and building materials mainly, amounted in 1896 to 29,095 tons, in 1897 to 51,673 tons, in 1900 to 64,685 tons, and in 1901 to 20,705 tons.

Detailed description of this improvement is printed in the Annual Report of the Chief of Engineers for 1900, page 1381. Sketch of the harbor is printed in Annual Report of the Chief of Engineers for 1886, page 658.

July 1, 1901, balance unexpended	$88.20
Amount appropriated by river and harbor act approved June 13, 1902	6,000.00
	6,088.20
June 30, 1902, amount expended during fiscal year	48.60
July 1, 1902, balance unexpended	6,039.60

(See Appendix H 2.)

3. Larchmont Harbor, New York.—[This work was in the charge of Col. S. M. Mansfield, Corps of Engineers, to January 31, 1902, and in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, from January 31 to June 12, 1902.]—This harbor, situated on the northwest shore of Long Island Sound, 4 miles distant from New York City limits, is about half a mile wide and five-eighths of a mile long. It is exposed to easterly and southerly storms. Two submerged rocks (Umbrella Rock and Huron Rock) obstruct the entrance, which has a depth of 18 feet, gradually diminishing toward the head of the bay.

The original project for this improvement, adopted September 19, 1890, provided for building two breakwaters to protect the anchorage ground, one to extend from Umbrella Rock to Umbrella Point and the other from Huron Rock to Long Beach Point, at an estimated cost of $105,000. Work under this project was suspended in 1891, after the first appropriation of $5,000 had been expended in commencing the two breakwaters.

The present project, approved March 3, 1899, provides for building a breakwater extending southwardly 1,440 feet from the 6-foot curve off Long Beach Point and for the removal of Huron Rock to a depth of 14 feet at mean low water. Estimated cost, $108,000.

Up to June 30, 1902, $50,000 had been expended on present project.

The expenditure during the fiscal year ending June 30, 1902, was applied to constructing the breakwater intended to protect vessels using the harbor from easterly and southerly winds.

The maximum draft that could be carried June 30, 1902, over the shoalest part of the entrance channel at mean low water was 18 feet.

The general depth of the anchorage area of the harbor is from 6 to 12 feet at mean low water. Mean range of tides, 7.4 feet.

The commerce of the harbor is not large. It is mainly used by the Larchmont Yacht Club, and also by coasting and fishing vessels for night anchorage and as a harbor of refuge.

Detailed description of this improvement is printed in the Annual Report of the Chief of Engineers for 1899, page 1213.

A sketch of Larchmont Harbor is printed in House Ex. Doc. No. 40, Fifty-first Congress, first session.

July 1, 1901, balance unexpended	$13,273.07
Amount appropriated by river and harbor act approved June 13, 1902	10,000.00
	23,273.07
June 30, 1902, amount expended during fiscal year	13,273.07
July 1, 1902, balance unexpended	10,000.00

(See Appendix H 3.)

4. Bronx River and East Chester Creek, New York.—(*a*) *Bronx River.*—[This work was in the charge of Col. S. M. Mansfield, Corps of Engineers, to January 31, 1902, and in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, from January 31 to June 12, 1902.] The navigable part of this stream, which empties into the East River north of Hunts Point, extends from the mouth to West Farms, a distance of 3 miles. At the latter place it is crossed by a dam.

The natural depth was 4 feet at mean low water at its mouth, decreasing to less than 1 foot at the head of navigation.

The project for improvement approved June 3, 1896, provides for making a channel 4 feet deep and 100 feet wide at and near the mouth, thence decreasing in width to 50 feet at the head of navigation, the work to be done by dredging and rock removal. Estimated cost, $85,985.

Up to June 30, 1902, $28,525.99 had been expended upon the improvement.

The expenditure during the past fiscal year was applied to removing 118 cubic yards of rock from a ledge which greatly interfered with navigation on the west side of the drawbridge of the Harlem River branch of the New York, New Haven and Hartford Railroad.

The maximum draft that could be carried on June 30, 1902, over the shoalest part of the channel at mean low water up to Stephens's dock was 3 feet; above that point, 1 foot. Mean range of tides, 6.6 feet at the mouth, 6 feet at West Farms.

The commerce of this river, mainly in coal, lumber, building materials, cotton goods, drugs for dyeing purposes, and ice, amounted to

139,310 tons in 1897, to 171,300 tons in 1899, to 166,500 tons in 1900, and to 168,000 tons in 1901.

The navigation of the river has been greatly benefited by the work already accomplished.

Details as to this improvement may be found in the Annual Report of the Chief of Engineers for 1897, page 1093. No map of the Bronx River has been printed in annual reports.

(*b*) *East Chester Creek.*—[This work was in the charge of Col. S. M. Mansfield, Corps of Engineers, to January 31, 1902, and in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, from January 31 to June 12, 1902.] Before improvement, this small tidal stream, emptying into Pelham Bay, was navigable at high tide for vessels drawing 7 feet as far as Lockwoods, a distance of 2¼ miles.

The project for improvement, approved March 3, 1873, provided for a channel 100 feet wide and 9 feet deep, mean high water, from deep water in Pelham Bay to a point 3,000 feet above Lockwoods. Estimated cost, $136,500, subsequently reduced to $124,000.

Up to June 30, 1902, $90,901.32 had been expended on the work, of which amount $810.16 was for maintenance.

No work was done during the past fiscal year, sufficient funds not being available.

The condition of the improvement, which is considered to be completed, remains about the same as described in the report of the Chief of Engineers for 1900, page 1388.

The maximum draft that could be carried June 30, 1902, over the shoalest part of the channel at mean low water was 2 feet. Mean range of tides, 7.1 feet.

The commerce, mainly in coal, building material, stone, and miscellaneous freight, amounted to 94,928 tons in 1896; 286,428 tons in 1899; 300,475 tons in 1900, and in 1901 to 225,357 tons.

For details regarding work at this locality see Annual Report of the Chief of Engineers for 1900, page 1089. A sketch of this creek is printed in the Annual Report of the Chief of Engineers for 1893, page 968.

July 1, 1901, balance unexpended	$4,017.45
Amount appropriated by river and harbor act approved June 13, 1902	8,000.00
	12,017.45
June 30, 1902, amount expended during fiscal year	2,444.76
July 1, 1902, balance unexpended	9,572.69

(See Appendixes H 4 and 5.)

5. Mattituck Harbor, New York.—[This work was in the charge of Col. S. M. Mansfield, Corps of Engineers, to January 31, 1902, and in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, from January 31 to June 12, 1902.] This harbor is a tidal inlet extending in a southerly direction from Long Island Sound to the village of Mattituck, Long Island, a distance of about 2 miles.

One mile above the mouth a tide milldam with gates has been built across the stream. The depth at the entrance, which is obstructed by a shifting sand bar, is from 1 to 2 feet, thence up to the milldam from 2 to 7 feet, at low tide, and above the latter the depth is 6 feet at high tide.

The project, approved June 3, 1896, provides for a channel 7 feet deep at mean low water from the entrance to the dam, and 7 feet deep at mean high water above the dam to the village, the width to be 80 feet except at the mouth, where it is increased to 100 feet; the entrance channel to be protected by parallel jetties. Estimated cost, $83,000.

Up to June 30, 1902, $15,000 had been expended upon the improvement.

The expenditure during the year was applied to the final payment on a contract which was completed on July 2, 1901, under which 680 feet of the west jetty was constructed. This jetty, which is nearly completed, will serve to some extent to fix the entrance channel, but navigation will not be materially benefited until both jetties have been completed and the entrance channel has been deepened by dredging.

The maximum draft that could be carried June 30, 1902, over the shoalest part of the channel at mean low water was 1 foot. Mean range of tides at entrance, 4.8 feet; below dam, 2.2 feet.

The greater part of the local freight is shipped and received by rail, as in its present condition the harbor can be navigated only by boats of very light draft.

Details as to this improvement may be found in Annual Reports of the Chief of Engineers for 1891, page 843, and for 1897, page 1095.

No map of Mattituck Harbor has been printed in annual reports.

July 1, 1901, balance unexpended	$4,870.92
June 30, 1902, amount expended during fiscal year	4,870.92

(See Appendix H 6.)

6. Harbors at Port Jefferson, Huntington, Glencove, Flushing Bay, Canarsie Bay, and Sag Harbor, N. Y.—(a) Port Jefferson Harbor.—[This work was in the charge of Col. S. M. Mansfield, Corps of Engineers, to January 31, 1902, and in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, from January 31 to June 12, 1902.] This harbor, situated on the north shore of Long Island, is a large and deep inland bay, connected with Long Island Sound by a narrow entrance.

Before improvement the channel depth outside the entrance was but 4 feet at mean low water, whereas the depth in the harbor was 12 feet and more at low tide up to within 300 feet of the wharves of Port Jefferson village.

The first project for improvement was adopted in 1871 and completed in 1883 at a total cost of $79,000. Two jetties were built to shelter the inlet channel, one east of the inlet, 1,390 feet long, and one west, 940 feet, both of scant cross section. A channel 8 feet deep at mean low water and 100 feet wide was dredged through the inlet and the shoal outside.

The existing project for improvement, approved September 19, 1890, and modified August 18, 1894, provides for dredging a channel through the harbor entrance 12 feet deep and 200 feet wide, to be protected by extending and enlarging the previously built jetties. Estimated cost, $145,000.

The expenditure on the present project up to June 30, 1902, amounted to $57,187.68.

The maximum draft that could be carried June 30, 1902, over the shoalest place in the channel was abount 12 feet at mean low water. Mean range of tides: At entrance, 7 feet; at wharves, Port Jefferson, 6.2 feet.

The commerce of this harbor, mainly in coal, building materials, farm produce, shellfish, and general merchandise, amounted in 1898 to 24,940 tons, in 1899 to 42,130 tons, in 1900 to 40,380 tons, and in 1901 to 38,200 tons.

Detailed description of this work may be found in the Annual Report of the Chief of Engineers for 1895, pages 831 to 835.

A sketch of Port Jefferson Inlet was printed in the Annual Report of the Chief of Engineers for 1886, page 660.

(*b*) *Huntington Harbor.*—[This work was in the charge of Col. S. M. Mansfield, Corps of Engineers, to January 31, 1902, and in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, from January 31 to June 12, 1902.] This harbor is a narrow tidal estuary extending inland from Huntington Bay, Long Island, in a southerly direction, for a distance of about 2 miles.

Before improvement it had a natural available depth of nearly 8 feet, mean low water, for a stretch of 1¼ miles from the entrance southward, thence gradually decreasing to zero toward the head of the harbor.

In 1872 the first project was adopted under which in 1873 a shoal at the harbor entrance was removed and a channel 2,200 feet long, 130 to 150 feet wide, and 8 feet deep at mean low water was dredged up to the town landings at a total cost of $22,500.

In 1884 this channel had completely filled up.

The present project, adopted September 19, 1890, provides for dredging and maintaining a channel 8 feet deep and 100 feet wide up to the upper wharves, to be protected by piling if necessary. Estimated cost, $32,000.

Up to June 30, 1902, $29,489.06 had been expended in carrying out and maintaining the present project.

No work was in progress during the past fiscal year, sufficient funds not being available.

The maximum draft that could be carried June 30, 1902, was 8 feet at mean low water. Mean range of tides, 7.2 feet.

The commerce of the harbor, mainly in coal, farm produce, building material, and miscellaneous merchandise, amounted to 23,584 tons in 1897, to 46,500 tons in 1899, to 45,600 tons in 1900, and to 52,000 tons in 1901.

Detailed description of this improvement is printed in the Annual Report of the Chief of Engineers for 1897, pages 1100 to 1102.

A sketch of the upper part of the harbor is printed in the Annual Report for 1893, page 976.

(*c*) *Glencove Harbor.*—[This work was in the charge of Col. S. M. Mansfield, Corps of Engineers, to January 31, 1902, and in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, from January 31 to June 12, 1902.] This harbor is a small tidal inlet on the east side of Hempstead Harbor, Long Island. Its channel is about 2 feet deep at mean low water, and a bar at the entrance has a foot less depth. Before the improvement was made vessels waiting for tides to enter the harbor were exposed to storms from the north and northwest. Range of tides, 7.7 feet.

The existing project, approved August 11, 1888, and revised June 22, 1895, provides for the construction of a breakwater in Hempstead Harbor, extending from the northwest corner of Glencove dock west-southwestwardly toward Motts Point, so as to shelter the anchorage outside of Glencove Harbor. This breakwater is to have a length of 2,000 feet, and to be built to a height of 3 feet above high water, with a top width of 5 feet; estimated cost, $135,000.

Up to June 30, 1902, $63,000 had been expended in carrying out the work.

No operations were in progress during the past fiscal year, no funds being available.

The condition of the improvement remains about the same as stated in the Annual Report of the Chief of Engineers for 1900, page 1400.

The commerce of the harbor, in coal, grain, building materials, and general merchandise, amounts to about 700,000 tons annually.

The benefit derived from the work accomplished is fully proportionate to the amount expended.

Details as to the improvement may be found in the Annual Report of the Chief of Engineers for 1897, page 1103. A map was printed in the Annual Report of the Chief of Engineers for 1889, page 728.

(*d*) *Flushing Bay.*—[This work was in the charge of Col. S. M. Mansfield, Corps of Engineers, to January 31, 1902, and in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, from January 31 to June 12, 1902.] Before improvement the controlling depth in the channel up to Flushing was 3.9 feet, mean low water.

The existing project, approved March 3, 1879, and modified September 19, 1888, and June 9, 1891, provides for building a dike 4,663 feet long on the west side of the channel, to protect it from filling, and for making and maintaining a channel 6 feet deep and 200 feet wide at mean low water up to the lower bridge at Flushing. Estimated cost, $173,500.

Up to June 30, 1902, $122,540.53 had been expended upon this improvement. How much of this amount may properly be considered to have been used for maintenance can not be definitely stated, as it was necessary during the progress of the work to dredge some parts of the channel repeatedly.

No work was in progress during the past fiscal year. The improvement remains in about the same condition as reported on page 1401, Annual Report of the Chief of Engineers for 1900.

The maximum draft that could be carried June 30, 1902, over the shoalest part of the channel at mean low water was fully 6 feet, as projected. The channel required widening. Mean range of tides, 7.1 feet.

The principal articles of commerce are coal, building and paving materials, dyewoods, logwood extracts, and miscellaneous merchandise, amounting to 163,395 tons in 1897, to 158,755 tons in 1899, to 177,575 tons in 1900, and to 200,473 tons in 1901.

Details as to the improvement may be found in the Annual Report of the Chief of Engineers for 1897, page 1106. A map is printed in the Annual Report of the Chief of Engineers for 1899, page 732.

(*e*) *Carnarsie Bay.*—[This work was in the charge of Col. S. M. Mansfield, Corps of Engineers, to January 31, 1902, and in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, from January 31 to June 12, 1902.] This bay forms the northwest part of Jamaica Bay at Canarsie landing. The original depth from the landing to Big Channel was 4.2 feet and to Island Channel 1.3 feet at mean low water.

The project for this improvement, approved June 14, 1880, and subsequently enlarged in 1889 and 1896, provides for the construction of two dikes and dredging between them where necessary to secure a channel 100 to 150 feet wide and 6 feet deep, connecting the steamboat dock at Canarsie with Big Channel, Jamaica Bay; also for a channel 4 feet deep and about 50 feet wide, running in a southwesterly direction from Canarsie landing to Island Channel, and for a channel 5 feet deep and 50 feet wide running in a northeasterly direction to Gophel Channel. Estimated cost, $88,000.

Up to June 30, 1902, $64,574.18 had been expended in carrying out the improvement under the project.

No work was in progress during the past fiscal year.

The maximum draft that could be carried June 30, 1902, over the shoalest part at mean low water was 5 feet in the main channel, 2½ feet in the West Branch, and 3½ feet in the East Branch. Mean range of tides, 4.7 feet.

The commerce of Canarsie Bay, mainly in building materials, fertilizers, fish, and coal, amounted to about 50,000 tons in 1896. In 1901 the commerce of Jamaica Bay, which was greatly benefited by this improvement, was 450,000 tons.

Details as to this improvement may be found in the Annual Report of the Chief of Engineers for 1897, page 1114. A sketch of Canarsie Bay is printed in the Annual Report of the Chief of Engineers for 1882, page 670.

(*f*) *Harbor at Sag Harbor.*—This harbor lies on the northern shore of Long Island, about 24 miles west of Montauk Point. It is a small bay sheltered by Long Island on the south and west and partly by Shelter Island on the north.

The river and harbor act of June 13, 1902, adopted a project for improvement of the harbor in accordance with report submitted in House Doc. No. 77, Fifty-sixth Congress, first session (see Annual Report of the Chief of Engineers for 1900, p. 1451), which contemplates protecting the harbor and landings by a breakwater estimated to cost $71,000.

No work has been done under the project.

July 1, 1901, balance unexpended	$1,425.65
Amount appropriated by river and harbor act approved June 13, 1902	39,500.00
	40,925.65
June 30, 1902, amount expended during fiscal year	217.10
July 1, 1902, balance unexpended	40,708.55

(See Appendixes H 7–11.)

7. *Browns Creek, New York.*—[This work was in the charge of Col. S. M. Mansfield, Corps of Engineers, to January 31, 1902, and in the

charge of Lieut. Col. C. W. Raymond, Corps of Engineers, from January 31 to June 12, 1902.] This narrow stream, which empties into Great South Bay, Long Island, near Browns Point, had a natural depth of from 1 to 3 feet at low tide, a bar at the mouth having less than 1 foot.

The project for improvement, approved September 19, 1890, provides for a channel 100 feet wide and 4 feet deep, to extend from deep water in the bay up to Sayville highway bridge, and to be protected at the entrance by jetties on both sides. Estimated cost, $46,000.

Up to June 30, 1902, $27,627.02 had been expended upon the improvement, of which amount $25,000 had been used to carry out the project and $2,627.02 for maintenance.

No work was in progress during the past fiscal year.

The maximum draft that could be carried June 30, 1902, over the shoalest part at mean low water was 4 feet. Mean range of tides, 1 foot.

The condition of the improvement remains about the same as described in the Annual Report of the Chief of Engineers for 1900, page 1417.

The commerce of this creek, mainly in coal, building materials, fish, and shellfish, amounted in 1898 to 10,700 tons, in 1899 to 11,642 tons, in 1900 to 12,272 tons, and in 1901 to 17,025 tons.

Details in reference to this work may be found in the Annual Report of the Chief of Engineers for 1897, page 1111. A sketch of this creek is printed in the Annual Report of the Chief of Engineers for 1894, page 710.

July 1, 1901, balance unexpended	$463.45
June 30, 1902, amount expended during fiscal year	90.47
July 1, 1902, balance unexpended	372.98

(See Appendix H 12.)

8. Patchogue River, New York.—[This work was in the charge of Col. S. M. Mansfield, Corps of Engineers, to January 31, 1902, and in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, from January 31 to June 12, 1902.] Before improvement this small inlet, extending from Great South Bay, Long Island, to the village of Patchogue, had a natural depth of about 2 feet.

The first project for improvement, approved September 19, 1890, provided for a channel about 5,000 feet long, 60 feet wide, and 6 feet deep, to be protected at its mouth against westerly storms by a jetty 1,700 feet long. Estimated cost, $40,000.

Up to June 30, 1902, $40,000 had been expended in carrying out this project, which has been completed.

The present project for improvement of Patchogue River has been merged into the general plan of improvement authorized by the river and harbor act approved June 13, 1902, as stated in House Doc. No. 103, Fifty-sixth Congress, second session, and in the Annual Report of the Chief of Engineers for 1901, page 1249.

This project provides for dredging a channel from Fire Island Inlet to Patchogue. From the inlet to the central basin in Great South Bay the low-water depth is to be 10 feet and width 200 feet, and from the central basin to Patchogue the channel is to be 8 feet deep and 100

feet wide at mean low water, all at an estimated cost of $66,000, and $2,000 annually for maintenance.

The available balance was expended during the past year for maintenance work.

The maximum draft that could be carried June 30, 1902, over the shoalest part of the channel at mean low water was 6 feet. Mean range of tides, 1 foot.

The commerce of this river is mainly in coal, lumber, fish and shellfish, and miscellaneous merchandise. It amounted in 1898 to 255,200 tons, in 1899 to 266,800 tons, in 1900 to 274,100 tons, and in 1901 to 281,300 tons.

Details as to the improvement of Patchogue River may be found in the Annual Reports of the Chief of Engineers for 1897, Part I, page 1108, and for 1901, page 1249.

A sketch is printed in Annual Report of the Chief of Engineers for 1893, page 984.

PATCHOGUE RIVER.

July 1, 1901, balance unexpended	$706.85
June 30 1902, amount expended during fiscal year	706.85

FIRE ISLAND INLET.

Amount appropriated by river and harbor act approved June 13, 1902	$66,000
July 1, 1902, balance unexpended	66,000

(See Appendix H 13.)

9. Passaic River, New Jersey.—[This work was in the charge of Col. S. M. Mansfield, Corps of Engineers, to January 31, 1902, and in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, from January 31 to June 12, 1902.] This river is a stream of considerable size, rising among the highlands in the northern part of New Jersey and flowing in a general easterly and southerly course into Newark Bay. It is navigable from its mouth to Passaic, a distance of about 16 miles. In its natural condition the navigable depth to Newark was about 7 feet at mean low water; from Newark to Passaic it was about 3 feet.

The first project for improvement, adopted by the river and harbor act of June 10, 1872, was for providing a channel from Newark to Passaic from 6 to 7½ feet deep and from 50 to 200 feet wide, the first cost being estimated at $123,924; this was subsequently increased to $193,822.

A subsequent project for improving the river below Newark was authorized by the river and harbor act of June 14, 1880, at an estimated cost of $353,875. It proposed a channel 200 feet wide and 10 feet deep at mean low water up to Center Street Bridge, Newark.

The two projects were consolidated by the river and harbor act of July 13, 1892, the estimated cost of the improvement being $547,697.

The amount expended under this consolidated project up to the close of the fiscal year ending June 30, 1902, was $468,350, of which $389,610 was used in carrying out the projects and $78,740 for maintenance.

By the passage of the river and harbor act approved June 13, 1902, a new project has been adopted for part of the river, as follows:

"Improving Passaic River, New Jersey, in accordance with the report submitted in House Doc. No. 401, Fifty-sixth Congress, first session, from Staten Island Sound through Newark Bay and the said river to the Montclair and Greenwood Lake Railroad bridge, with a channel 12 feet deep to the Nairn Linoleum Works, and 10 feet deep from that point to the said railroad bridge." Estimated cost, $296,000. The old project for improving the river below Newark is merged into this new project.

The adoption of this new project for the lower part of the river leaves in force the part of the old project above Newark, which is included between the Montclair and Greenwood Lake Railroad bridge and Passaic.

Up to June 30, 1902, $173,734, including maintenance, had been expended on this part of the project, leaving approximately $43,000, which includes the amount expended for maintenance, as the estimated cost of completion. The annual cost of maintenance is estimated as $5,000.

No work was done during the past year owing to lack of sufficient funds.

The maximum drafts that could be carried June 30, 1901, were as follows: Nine and five-tenths feet to the Center Street Bridge, Newark; 7 feet to the Erie Railroad bridge, Newark, and 5.25 feet to Passaic. It is believed that these depths still exist. Mean range of tides: At mouth of river, 4.7 feet; at Passaic, 2.5 feet.

The commerce of this river is mainly in building material, iron ore, fertilizers, coal, and general merchandise, and amounted to 1,509,772 tons in 1898, to 1,962,462 tons in 1899, to 2,037,363 tons in 1900, and to 2,009,356 tons in 1901.

Details as to this improvement may be found in the Annual Report of the Chief of Engineers for 1900, page 177, and further details are in the Annual Report of the Chief of Engineers for 1896, pages 770 to 774.

Maps showing mouth of river and Newark Bay are printed in Annual Reports of the Chief of Engineers for 1882, page 686, and for 1887, page 766, and maps of the river above the mouth are printed in House Doc. No. 401, Fifty-sixth Congress, first session.

July 1, 1901, balance unexpended	$40.00
July 12, 1901, amount alloted from appropriation for emergencies in river and harbor works, act of June 6, 1900	1,000.00
Amount appropriated by river and harbor act approved June 13, 1902	75,000.00
	76,040.00
June 30, 1902, amount expended during fiscal year	40.00
July 1, 1902, balance unexpended	76,000.00
Amount (estimated) required for completion of existing project	264,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	100,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix H 14.)

10. Arthur Kill, or Staten Island Sound, and channel between Staten Island and New Jersey.—[This work was in the charge of Col. S. M.

Mansfield, Corps of Engineers, to January 31, 1902, and in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, from January 31 to June 12, 1902.] This channel is an inland waterway, about 17 miles long, connecting New York Harbor with Raritan Bay. It consists of the Kill van Kull, connecting the Upper Bay with Newark Bay, and the Arthur Kill, connecting Newark Bay with Raritan Bay.

The natural depth through the channel was 15 feet or more, except for a distance of about 1¼ miles in Newark Bay, where there was a shoal with a crooked channel 9½ feet deep.

The first project, adopted by the river and harbor act of June 23, 1874, was for making a channel from 14 to 16 feet deep through this shoal, at an estimated cost of $443,211. The only work done under it was the building of 2,237 linear feet of diking, at a cost of $50,000.

A second project was adopted in 1880, which proposed to dredge through the shoal a channel 400 feet wide and 14 feet deep at mean low water, the cost being estimated at $210,000.

A supplemental project was adopted by the river and harbor act of August 11, 1888, which had for its object the removal of the point of land known as Steep Point and the straightening of the channel to the westward of the Baltimore and Ohio Railroad bridge. The cost was estimated at $26,500, and the work was completed in 1895, at a cost of $25,401.30. This amendment brought the total cost of the improvement up to $286,500.

The river and harbor act of June 3, 1896, extended the project to include the dredging of a channel in Lemon Creek, on Staten Island, at a cost of $5,000.

The total amount expended to June 30, 1902, on all previous projects was $289,649.12 (including $5,000 spent on Lemon Creek), which was applied to diking, to dredging a channel 14 feet deep and 400 feet wide through the shoal in Newark Bay, to removing Steep Point, and to dredging a channel in Lemon Creek 8 feet deep and from 35 to 50 feet wide.

By the enactment of the river and harbor law of June 13, 1902, this improvement has been merged into the general plan of improvement of the Arthur Kill, or Staten Island Sound, from Kill van Kull to Raritan Bay, New York and New Jersey, which provides for making and maintaining a channel, by dredging and diking, 300 feet wide and 21 feet deep at mean low water, at an estimated cost of $696,000, and $5,000 for annual cost of maintenance, in accordance with report submitted in House Doc. No. 393, Fifty-sixth Congress, first session, and also printed in Annual Report of the Chief of Engineers for 1900, pages 1525 to 1530.

No work in furtherance of the project was done during the past fiscal year.

The maximum draft that could be carried June 30, 1902, through the Staten Island channel was 14 feet at mean low water. Mean range of tides, 5 feet.

The freight carried through this waterway consists of oil, coal, ores, clay products, chemicals, fertilizers, grain, machinery, manufactures, and general merchandise, and amounted in 1898 to 10,184,261 tons, in 1899 to 11,311,991 tons, in 1900 to 11,047,633 tons, and in 1901 to 11,651,300 tons.

Further details as to this improvement may be found in the Annual Reports of the Chief of Engineers for 1896, page 775, and for 1900, page 178.

Maps of this work are printed in Annual Reports of the Chief of Engineers for 1881, page 696, and for 1889, page 822, and in House Doc. No. 393, Fifty-sixth Congress, first session.

July 1, 1901, balance unexpended	$2,018.50
Amount appropriated by river and harbor act approved June 13, 1902 (including $5,000 for Lemon Creek, New York)	110,000.00
	112,018.50
June 30, 1902, amount expended during fiscal year	167.62
July 1, 1902, balance unexpended	111,850.88
Amount (estimated) required for completion of existing project	596,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	150,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix H 15.)

11. Woodbridge Creek, New Jersey —A project for improvement of this locality, adopted in 1879, proposed a uniform depth of 12 feet at mean high water in a channel 80 feet wide from the mouth of the creek as far up as Salamander dock at Woodbridge, the sum of $19,000 having been appropriated and expended in prosecuting the work.

The project adopted by the river and harbor act of June 13, 1902, contemplates obtaining a channel 8 feet deep at mean low water, with a bottom width of 50 feet, by dredging, from Arthur Kill to Salamander dock, at an estimated cost of $35,000. It is estimated that $3,000 will be required annually for maintenance. This project is printed in House Doc. No. 282, Fifty-sixth Congress, first session, and in the Annual Report of the Chief of Engineers for 1900, page 1552.

There were no operations during the past year.

Amount appropriated by river and harbor act approved June 13, 1902	$17,000.00
July 1, 1902, balance unexpended	17,000.00

12. Raritan Bay, New Jersey.—[This work was in the charge of Col. S. M. Mansfield, Corps of Engineers, to January 31, 1902, and in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, from January 31 to June 12, 1902.] This bay is a large body of water lying between the southern end of Staten Island and the New Jersey shore. Its greatest width north and south is about 5 miles, and its greatest length east and west is about 7 miles. The Raritan River empties into it at its west end between Perth Amboy and South Amboy; and the Arthur Kill, or Staten Island Sound, extends northward, connecting it with Newark Bay.

This bay had naturally a fairly straight channel, 11 feet deep, to South Amboy. The line of the deepest water, however, followed the Staten Island shore from Perth Amboy to Seguine Point, where it was separated from deep water in the eastern part of the bay by a shoal 1.5 miles broad with a minimum depth of 14.5 feet.

The existing project, approved March 3, 1881, amended September 19, 1890, and June 3, 1896, proposes to dredge channels 300 feet wide

and 21 feet deep, from Seguine Point to deep water in the bay; through two shoals opposite Wards Point, and from South Amboy to deep water near Great Beds light. The estimated cost of the work was $507,875.

The amount expended on the work up to the close of the fiscal year ending June 30, 1902, was $441,570, of which $297,314.45 was used in carrying out the project and $144,255.55 for maintenance. The latter sum must now be added to the estimate for completion of project.

No work was done during the past fiscal year.

The maximum draft that could be carried, June 30, 1902, through the Wards Point channel was 19.5 feet, and through the Seguine Point and South Amboy channels 21 feet, all at mean low water. Mean range of tides, 5 feet.

The commerce of the bay is mainly in coal, brick, manufactures, and general merchandise, and amounted in 1898 to 5,552,474 tons; in 1899 to 6,507,402 tons; in 1900 to 6,537,977 tons, and in 1901 to 4,722,048 tons.

For details of this improvement see Annual Report of the Chief of Engineers for 1896, pages 787–789.

No map has been printed to accompany annual reports.

July 1, 1901, balance unexpended	$930.00
Amount appropriated by river and harbor act approved June 13, 1902	45,000.00
July 1, 1902, balance unexpended	45,930.00

(See Appendix H 16.)

13. Keyport Harbor, Matawan Creek, Raritan, South, and Elizabeth rivers, and Shoal Harbor and Compton Creek, New Jersey.—(*a*) *Keyport Harbor.*—[This work was in the charge of Col. S. M. Mansfield, Corps of Engineers, to January 31, 1902, and in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, from January 31 to June 12, 1902.] This harbor consists of a bay about 1 mile broad on the south shore of Raritan Bay.

There was no distinct natural channel in the harbor, the available depth to the wharves being less than 4 feet at mean low water. A 6-foot channel had been dredged at private expense before the United States assumed charge of the improvement, but it had shoaled again to 5 feet.

The existing project, approved August 2, 1882, contemplates dredging an 8-foot channel, 200 feet wide, from Raritan Bay to the steamboat dock at Keyport, at an estimated cost of $40,475.

The amount expended to June 30, 1902, was $45,475, of which sum $30,500 was used in carrying out the project, and $14,975 in maintenance.

No work was done during the past year, there being no available funds.

The maximum draft that could be carried June 30, 1902, to the Keyport wharves was about 7 feet at mean low water. Mean range of tides, 4.9 feet.

The commerce of this harbor is mainly in farm products, fertilizers, coal, lumber, fish, shellfish, and miscellaneous freight, and amounted to 105,200 tons in 1896, to 109,200 tons in 1897, to 67,500 tons in 1899, and to 45,000 tons in 1901.

Further details as to this work are printed in the Annual Report of the Chief of Engineers for 1897, page 1147. No sketch of this work has been printed in annual reports.

(*b*) *Matawan Creek.*—[This work was in the charge of Col. S. M. Mansfield, Corps of Engineers, to January 31, 1902, and in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, from January 31 to June 12, 1902.] This creek is a small tidal stream in the eastern part of New Jersey, which discharges into Raritan Bay at Keyport Harbor. It is navigable up to the bridge of the New York and Long Branch Railroad, about 1¼ miles above its mouth.

In its natural condition the mouth was obstructed by a mud flat, through which a narrow and crooked 3-foot channel existed. Above this flat there was a 4-foot channel for a mile, and beyond a narrow 3½-foot channel extending nearly up to the head of navigation, at Matawan.

The existing project for improving this stream, by dredging a 4-foot channel 100 feet wide from the mouth to Winkson Creek, about 1 mile, and thence 75 feet wide to the railroad bridge at Matawan, was approved March 3, 1881. The cost was estimated at $33,120.

The amount expended to June 30, 1902, was $42,120, of which $21,000 was used in carrying out the project and $21,120 for maintenance.

No work was done during the past year owing to the lack of funds.

The maximum draft that could be carried June 30, 1902, was 4 feet at mean low water. Mean range of tides, 4.9 feet.

The commerce of this creek is in brick, fertilizers, farm produce, and general merchandise, and amounted to 51,000 tons in 1899 and to 60,000 tons in 1901.

Further details as to this improvement may be found in the Annual Report of the Chief of Engineers for 1897, page 1145. No sketch of this creek has been printed in annual reports.

(*c*) *Raritan River.*—[This work was in the charge of Col. S. M. Mansfield, Corps of Engineers, to January 31, 1902, and in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, from January 31 to June 12, 1902.] This river is a moderate-sized stream flowing through the central part of the State of New Jersey and emptying into Raritan Bay at Perth Amboy. It is navigable to New Brunswick, N. J., a distance of 12 miles, where it is the eastern terminus of the Delaware and Raritan Canal.

In its natural state the channel to New Brunswick was obstructed by several extensive shoals, on which the depth was from 6½ to 8½ feet at mean low water.

The project for improvement, approved June 18, 1878, provided for a channel 200 feet wide and 10 feet deep, from the mouth to the Delaware and Raritan Canal terminus at New Brunswick, to be obtained by dredging, diking, and rock excavation, the cost being estimated at that time at $2,093,662. Recent and improved methods for doing such work have made it probable that this estimate will not exceed $1,035,000.

The amount expended up to the close of the fiscal year ending June 30, 1902, was $667,895, of which $659,192.32 was used in carrying on the work and $8,642.68 for maintaining that already done.

No work was done during the past year, owing to a lack of sufficient funds.

On June 30, 1902, the maximum draft that could be carried to the head of navigation was limited by gravel shoals below the rock cut to 8 feet at mean low water. No shoaling has been reported since that time. Mean range of tides: At mouth of river, 5.1 feet; at New Brunswick, 5.56 feet.

The commerce of this river is principally in coal, ores, lumber, building materials, and general merchandise, and amounted in 1897 to 1,218,752 tons, in 1898 to 1,255,972 tons, in 1899 to 1,523,391 tons, in 1900 to 1,476,645 tons, and in 1901 to 1,266,950 tons.

Details as to this improvement may be found in the Annual Reports of the Chief of Engineers for 1897, page 1136, and for 1900, page 1505. A map of the river is printed in the Annual Report of the Chief of Engineers for 1885, page 760.

(*d*) *South River.*—[This work was in the charge of Col. S. M. Mansfield, Corps of Engineers, to January 31, 1902, and in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, from January 31 to June 12, 1902.] This is a small stream in the central part of New Jersey, which discharges into the Raritan River about 8 miles above its mouth.

A private canal about three-quarters of a mile long had been dredged from near Washington, on the South River, to Sayreville, on the Raritan River, which shortened the sailing course about 2 miles.

The depth in the canal was about 3.5 feet, and in the river about 2.5 feet as far as Oldbridge, at the head of navigation, 6.3 miles above the canal.

The first project for this improvement was adopted March 3, 1871, and provided for dredging a channel 6 feet deep at mean low water up to the Washington wharves, at an estimated cost of $13,653. This was completed in 1874, at a cost of $20,000.

The present project, approved June 14, 1880, provides for correcting the canal outlet and for obtaining, by dredging and diking, a channel 100 feet wide and 8 feet deep to Washington, 1.5 miles above the mouth; thence 6 feet deep to Bissetts, 3.7 miles above the mouth; thence 4 feet deep to Oldbridge, 6.3 miles above the mouth, at the head of navigation. The cost was estimated at $194,695, but was reduced in 1892 to $176,975.

The amount expended on the present project up to the close of the fiscal year ending June 30, 1902, was $93,000, of which $78,000 was used for carrying on the work, and $15,000 for maintenance.

No work was done during the past year.

The maximum draft that could be carried to South River on June 30, 1901, was 8 feet, and to the railroad bridge above, 5 feet at mean low water. No shoaling has been reported since that time. Mean range of tides: At canal, 5.34 feet; at Oldbridge, 4.57 feet.

Large brick yards established along the banks of this river give it a commercial importance out of proportion to its size.

The commerce is principally in brick, clay, coal, and general merchandise, and amounted in 1897 to 308,563 tons, in 1898 to 274,381 tons, in 1899 to 343,202 tons, in 1900 to 414,288 tons, and in 1901 to 328,186 tons.

Details as to this improvement may be found in Annual Report of the Chief of Engineers for 1900, page 181.

Sketches of South River are printed in Annual Reports of the Chief of Engineers for 1882, page 678, and for 1885, page 764.

(*e*) *Elizabeth River.*—[This work was in the charge of Col. S. M. Mansfield, Corps of Engineers, to January 31, 1902, and in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, from January 31 to June 12, 1902.] This is a small stream in the eastern part of New Jersey, which discharges into the Arthur Kill at Elizabethport. Its width originally varied from 50 to 90 feet, and it had a high-water depth of 4 feet at the head of navigation at Broad street, Elizabeth, 2.62 miles above its mouth.

The existing project, approved March 3, 1879, consists in dredging a channel 60 feet wide and 7 feet deep at mean high water, at an estimated cost of $43,160.

The amount expended on this work to June 30, 1902, was $43,160, of which $27,000 was used for carrying out the project and $16,160 for maintenance.

No work was done during the past year owing to lack of funds.

The maximum draft that could be carried to Bridge street, Elizabeth, on June 30, 1901, was 1 foot at mean low water, and it is thought that that depth still exists. Mean range of tides: At mouth, 4.7 feet; at Bridge street, Elizabeth, 3.4 feet.

The commerce of this river is in coal, building materials, and miscellaneous freights. It amounted to 21,650 tons in 1895, to 36,066 tons in 1896, to 28,865 tons in 1897, and to 29,495 tons in 1901.

Details in reference to this improvement may be found in the Annual Reports of the Chief of Engineers for 1896, page 778, and for 1897, pages 1134 and 1185. No map of Elizabeth River has been printed in the annual reports.

(*f*) *Shoal Harbor and Compton Creek.*—[This work was in the charge of Col. S. M. Mansfield, Corps of Engineers, to January 31, 1902, and in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, from January 31 to June 12, 1902.] This harbor is on the south shore of Raritan Bay, 5 miles from Sandy Hook. Compton Creek is a narrow stream emptying into it. The natural harbor is inside the mouth of the creek, where the depth is from 3 to 6 feet at mean low tide. The creek is navigable for one-quarter of a mile above its mouth, where it is crossed by a highway bridge without a draw.

The entrance to this harbor was originally obstructed by a broad, flat shoal, on which there was a depth of less than 1 foot at mean low tide, the distance between the deep water in the creek and the 4-foot depth in the bay being about one-half mile.

The existing project, approved September 19, 1890, proposes a channel 4 feet deep connecting Compton Creek with Raritan Bay, the width to be 150 feet in the bay and 75 feet in and near the mouth of the creek, the channel through Shoal Harbor to be protected by a dike if necessary. The estimated cost of the work was $64,130.

The amount expended to June 30, 1902, was $24,000, of which sum $17,000 was applied to carrying out the project and $7,000 for maintenance.

No work was done during the past year, owing to lack of funds.

The maximum draft that could be carried June 30, 1901, in the channel through Shoal Harbor and Compton Creek was 3 feet at mean

low water. No shoaling has been reported since that date. Mean range of tides, 4.5 feet.

The commerce of this locality, in farm and fish products, fertilizers, and general merchandise, amounted to 184,000 tons in 1897, to 194,500 tons in 1898, to 226,000 tons in 1899, to 179,500 tons in 1900, and to 180,000 tons in 1901.

Further details as to this improvement may be found in the Annual Report of the Chief of Engineers for 1897, page 1150. No sketch of this work has been printed in annual reports.

July 1, 1901, balance unexpended	$3,550.00
Amount appropriated by river and harbor act approved June 13, 1902	43,000.00
	46,550.00
June 30, 1902, amount expended during fiscal year	195.00
July 1, 1902, balance unexpended	46,355.00

(See Appendixes H 17–22.)

14. Shrewsbury River, New Jersey.—[This work was in the charge of Col. S. M. Mansfield, Corps of Engineers, to January 31, 1902, and in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, from January 31 to June 12, 1902.] This river is a large tidal basin in the eastern part of New Jersey, and consists of two bays, each having an area of about 3 square miles, and known, respectively, as the North Branch, or Navesink River, and the South Branch. A channel called the main stem, unites the two branches at their eastern ends and extends northwardly to the southeast end of Sandy Hook Bay.

Before any improvement was begun by the United States the available depth to Oceanic, on the North Branch, 5 miles above the mouth, was 3.5 feet; to Branchport, on the South Branch, 9 miles above the mouth, it was 2.5 feet.

By act of Congress of August 30, 1852, $1,500 was appropriated for, and expended upon, a survey to ascertain the extent of a break through the beach between the Shrewsbury River and the ocean, but no work of improvement was begun.

First project: By act of Congress of July 11, 1870, a survey of the river was ordered. The report on this survey, printed in the Annual Report of the Chief of Engineers for 1871, page 702, described a bar across the river nearly opposite the Navesink lights, and four smaller bars above, and recommended deepening them by dredging, at an estimated cost of $14,000. The work was completed under appropriations amounting to $19,000, made in 1871 and 1873, and a new shoal near Lower Rocky Point was also dredged. The dredged channels did not long maintain the improved depth (6 feet at low tide).

Existing project with modifications: The river and harbor act of 1875 provided for a survey of the "North and South branches of the Shrewsbury River, New Jersey." The report on this survey, printed in the Annual Report of the Chief of Engineers for 1876, page 278, proposed dredging at Upper and Lower Rocky Point, and a training dike at the entrance to the North Branch, at a total estimated cost of $18,000. This sum was appropriated by the river and harbor act of 1878, but before beginning the work it was decided to make a new and more

detailed survey of the river. This survey was made in 1878, and the report printed in the Annual Report of the Chief of Engineers for 1879, page 405, presented a plan for improving both branches of the river and main stem to obtain a channel of 6 feet depth at mean low water, with a width of 300 feet in the main stem and of 150 feet in each of the branches, by dredging and constructing pile dikes or training walls. At this time the available depth in the main stem was found to be 5.4 feet at mean low water, in the North Branch 3.5 feet, and in the South Branch, at the entrance, 2.6 feet, practically suspending all navigation in the latter channel. The plan was referred to a Board of Engineers, and with slight modifications was approved by it February 12, 1879. It provided for the construction of 7 pile dikes and for dredging at seven different shoal points, at a total estimated cost of $142,086. This project was adopted March 3, 1879, when an appropriation of $10,000 was made for beginning work. No essential modification of this project has since been made. Such slight changes in the positions and lengths of the dikes have been adopted as experience during the progress of the work showed to be expedient, and many of the shoals have required redredging to maintain the proposed depth of 6 feet. Owing to these conditions and to the cost of dredging being generally greater than originally estimated, it was found necessary in 1881, 1883, and 1887 to add to the estimate for the completion of the whole work. The present project for improvement is the project of 1879 with the modifications indicated above, and proposes to secure a channel of 6 feet depth at mean low water, with width of 300 feet up to the junction of the North and South branches, and with a width of 150 feet in those branches, by means of dredging and diking, at an estimated cost (including appropriation of 1878 applied to this project) of $234,062.

The sum expended under the existing project at the close of the fiscal year ending June 30, 1902, was $254,000, of which $168,500 was for carrying out the project and $85,500 for maintenance.

With these expenditures 9 dikes have been built, and 6-foot channels, having widths of from 60 to 200 feet, have been dredged through the shoals in the main stem and branches; a temporary channel was also dredged west of Island Beach, in order to restore navigation for the season of 1897. These channels, not being permanent, have necessitated redredging at various localities more than once.

The expenditure during the past fiscal year was for maintenance, and was applied to restoring the channel in the main stem east of Island Beach.

The maximum draft that could be carried June 30, 1902, in the main stem of the river was 2 feet, in the North Branch 5½ feet, and in the South Branch 4 feet, at mean low water. Mean range of tides: Outer bar, 5 feet; Highland bridge, 3 feet; Seabright bridge, 1.3 feet.

The commerce of this river, mainly in coal, farm produce, fertilizers, and general merchandise, amounted in 1898 to 1,003,000 tons, in 1899 to 906,000 tons, in 1900 to 804,000 tons, and in 1901 to 488,000 tons. The passenger traffic is important, the number of people carried in 1901 being 209,204.

Further details in reference to this work may be found in Annual Reports of the Chief of Engineers for 1896, page 797, and for 1900, page 185.

Sketches of Shrewsbury River are printed in the Annual Reports of the Chief of Engineers for 1879, 1881, 1882, 1887, 1890, 1891, and 1893.

Harbor lines were established in the Shrewsbury River in the vicinity of Seabright by the Secretary of War February 5, 1894, and at the mouth of the river, along the west shore up to the Highland bridge, March 9, 1892.

July 1, 1901, balance unexpended	$6,718.00
Amount appropriated by river and harbor act approved June 13, 1902	75,000.00
	81,718.00
June 30, 1902, amount expended during fiscal year	6,718.00
July 1, 1902, balance unexpended	75,000.00

(See Appendix H 23.)

15. Manasquan River, New Jersey.—[This work was in the charge of Col. S. M. Mansfield, Corps of Engineers, to January 31, 1902, and in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, from January 31 to June 12, 1902.] This is a small stream in the eastern part of New Jersey which empties into the Atlantic Ocean about 26 miles south of Sandy Hook.

In its natural condition the depth of the river for several miles above its mouth varied from 4 to 6 feet. The outlet, however, was obstructed by a shifting sand bar on which the depth did not exceed 1½ feet. After severe storms this outlet was sometimes entirely closed, remaining so until sufficient fresh water had accumulated in the river above to force an outlet into the ocean.

A project for its improvement, adopted by the river and harbor act of March 3, 1879, contemplated obtaining a permanent outlet for the river nearly at right angles to the shore, with a depth of 6 feet at mean low water, also dredging a channel in the lower river to the same depth. The estimated cost was $52,120. Work was suspended in 1883, after three appropriations, amounting to $39,000, had been expended on the improvement.

The existing project, approved March 3, 1899, which is a modification of the original project, contemplates obtaining an outlet 6 feet deep, for the river, and also in deepening the channel just above the mouth to the same depth, at an additional cost of $18,300 over the amount expended and on hand, making the total estimated cost of the improvement $59,300, to which should be added $1,075 expended for maintenance.

The amount expended to June 30, 1902, was $40,075, of which $39,000 was used for carrying out the project and $1,075 for maintenance.

No work was done during the past year.

The available balance will be held until another appropriation shall have been made, with the expectation that better prices will be obtained for a greater amount of work.

The maximum draft that could be carried June 30, 1902, was about 2 feet at mean low water. Mean range of tides, 2.4 feet.

The commerce amounts practically to nothing. The river is used principally by pleasure craft during the summer season.

Detailed description of this improvement with map is printed in the Annual Report of the Chief of Engineers for 1898, page 1070.

Full history of the work and map are printed in the Annual Reports of the Chief of Engineers, for 1880, Part I, pages 547 to 556, and for 1882, Part I, page 701.

July 1, 1901, balance unexpended	$5,925.00
July 1, 1902, balance unexpended	5,925.00

(See Appendix H 24.)

16. Delaware River, New Jersey and Pennsylvania.—[This work was in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, to October 1, 1901, and of Col. Jared A. Smith, Corps of Engineers, from October 1, 1901, to June 2, 1902.] Trenton, the head of natural navigation on the Delaware River, is about 30 miles above the upper end of the port of Philadelphia. In its original condition this stretch of river was obstructed by several shoals. Between Bordentown and Trenton, a distance of about 5 miles, a narrow and circuitous channel existed which carried only from 3 to 6 feet at mean low water. At Kinkora Bar, about 9 miles below Trenton, there was a shoal carrying 7½ feet, and at Fivemile Bar, opposite the upper part of Philadelphia, a shoal crossed the Pennsylvania channel, carrying only 3 to 4 feet at mean low water; there was, however, a depth of 13 feet past Fivemile Bar in the New Jersey channel south of Petty Island.

Below Philadelphia the river in its original condition presented obstructions at Mifflin Bar which reduced the depth at mean low water to 17 feet; at Schooner Ledge and Cherry Island Flats, to 18 feet; at Bulkhead Shoal and Baker Shoal, to about 20 feet; and at Duck Creek Flats to about 20 feet.

In that part of the Delaware River between Trenton, N. J., and Bridesburg, Pa., efforts in the past have been directed toward relieving commerce from the obstructions which exist in the upper 9 miles of the river, and toward deepening the channel across Kinkora Bar.

Previous to 1885 the efforts to improve the river between Philadelphia and the bay were confined to dredging, except at Schooner Ledge, where solid rock was removed. The work was done under appropriations for special localities, and also under general appropriations for the Delaware River below Bridesburg.

A Board of Engineers convened by direction of the Secretary of War for the purpose of considering the subject of the permanent improvement of Delaware River and Bay, recommended, under date of January 23, 1885, the formation of a ship channel from a point opposite Philadelphia and about midway between the American Shipbuilding Company's yard and the Gas Trust wharf to deep water in Delaware Bay, having a least width of 600 feet and a depth of 26 feet at mean low water. The formation of such a channel was to be obtained, except at Schooner Ledge, where rock would have to be removed, by regulating the tidal flow by means of dikes, with recourse to dredging where necessary as an aid to such contracting and regulating works.

The estimated cost of obtaining a channel of the above dimensions was about $2,425,000, which covered the estimated cost of the permanent improvement of the Delaware River between the upper part of Philadelphia and deep water in the bay. The annual cost of maintenance was estimated at 10 per cent of the original cost for dredging and 1 per cent of the original cost for dikes. This estimate of cost did not include the improvement of Philadelphia Harbor, which was a separate project.

In the river and harbor act approved March 3, 1899, Congress adopted a new project for the improvement of the river, providing for the formation of a channel 600 feet wide and 30 feet deep from Christian street, Philadelphia, to deep water in Delaware Bay, at an estimated cost of $5,810,000. This project superseded the project of 1885, which provided for a depth of 26 feet at mean low water. At the time of adoption of the new project the 26-foot channel, with widths varying from 200 to 600 feet, had been formed from the upper part of Philadelphia Harbor to the bay, except at the following-named localities: Tinicum Island Shoal, depth from 23.6 feet to 26 feet over a distance of about 4,200 feet; above Schooner Ledge, depth from 24 feet to 26 feet over a distance of about 4,800 feet; from below Marcus-hook to Bellevue, depth from 23 to 26 feet over a distance of about 13,500 feet. These distances are measured on the range lines. The distances, measured between the 26-foot curves on the lines of deepest water, were much shorter.

At the same time there was between Trenton and Philadelphia a channel 6 feet deep at mean low water through Perriwig Bar, a depth of 7 feet in the eastern channel at Bordentown, a channel 8½ feet deep through Kinkora Bar, and a channel 26 feet deep over the whole width through Five-mile Bar.

The entire amount expended on the improvement of the Delaware River from 1836 to June 30, 1902, under appropriations for special localities and the general river, was $3,296,534.05, of which $124,496.75 was expended on the part of the river between Trenton and Philadelphia.

The total amount expended on the 26-foot project, from its adoption in 1885 until it was superseded by the 30-foot project in 1899, was $1,598,621.51, of which about $200,000 is estimated to have been applied to maintenance.

Up to the close of the fiscal year ending June 30, 1902, the sum of $328,852.22 was expended on the work of existing project in surveys, in completing the work of rock removal opposite Petty Island, in continuing operations at Baker Shoals for the formation of a 30-foot channel, and in the construction of a bulkhead for the reception of dredged material. None of this amount was applied to maintenance of improvement.

The changes during the past fiscal year are summarized as follows:

The rock opposite Petty Island has been entirely removed to a plane of 26 feet below mean low water.

At Baker Shoal the work of bulkhead construction has resulted in the completion of about 11,697 linear feet of the structure. The work of dredging under the 30-foot project has resulted in the formation of a channel 30 feet deep at mean low water, about 20,500 feet long, and with an average width of 400 feet through the upper part of Baker Shoal

The greatest draft of water that could be carried at mean low water on June 30, 1902, over the shoalest part of the river below Philadelphia was about 20.2 feet at Cherry Island Flats. The nature of the bottom is such, however, that vessels pass over it without difficulty. The mean range of tide is 5.35 feet.

For 1890 the total foreign freight movement of the Delaware River was estimated at 2,923,994 tons and the total domestic freight movement at 8,433,276 tons; total, 11,356,270 tons. For 1901 the total foreign

freight movement was estimated at 4,462,628 tons and the total domestic freight movement at 19,627,896 tons; total, 24,090,524 tons.

The additional work proposed in the approved project, and for a part of which funds were provided by the river and harbor act of June 13, 1902, is necessary to make the improvement available and will largely benefit commerce.

COMMERCIAL STATISTICS.

The following statement concerning the foreign commerce of the Delaware River for the years ending December 31, 1900 and 1901, is compiled from the reports of the Board of Trade, the Commercial Exchange, and the Maritime Exchange of the city of Philadelphia:

Articles.	1900.	1901.
IMPORTS.	*Tons.*	*Tons.*
Chalk	12,761	44,213
Drugs and chemicals	92,135	89,673
Hemp, jute, flax, and their fabrics	27,425	31,151
Iron ore	511,958	332,651
Sugar	329,009	363,052
Miscellaneous	343,266	418,304
Total	1,316,554	1,279,044
EXPORTS.		
Coal	794,563	687,274
Grain and flour	1,443,508	1,076,777
Petroleum and products	756,134	1,041,856
Miscellaneous	519,321	377,677
Total	3,513,526	3,183,584

The following statement concerning the domestic and coastwise commerce of the Delaware River for the years ending December 31, 1900 and 1901, has been compiled from returns made by shippers, consignees, and carriers:

Articles.	1900.		1901.	
	Tons.	Value.	Tons.	Value.
ARRIVING.				
Chemicals	86,166	$1,552,913	82,563	$2,363,603
Coal	639,840	2,116,301	493,761	1,558,889
Lumber	678,265	7,555,519	961,743	12,661,662
Sand	942,440	711,719	1,100,601	748,577
Miscellaneous	4,384,814	791,984,153	3,921,329	561,459,804
Total	6,731,525	803,920,605	6,559,997	578,792,535
DEPARTING.				
Chemicals	76,467	1,782,854	84,334	1,952,160
Coal	8,025,877	27,801,651	8,085,591	36,988,151
Fertilizers	153,010	1,527,521	101,723	1,554,188
Iron, manufactured	106,870	4,829,835	123,511	4,896,443
Miscellaneous	4,266,150	576,591,018	4,672,940	451,954,286
Total	12,628,374	612,532,879	13,068,099	497,345,228

The apparent large decrease in the value of the miscellaneous domestic commerce for the year 1901 as compared with 1900 is due chiefly to the method of computation used. In 1900 shippers in only a few instances furnished values, and in other cases a value of $350 per ton was arbitrarily assumed for miscellaneous freight; in 1901 shippers themselves furnished the values. The amounts shown for the latter year are believed, therefore, to be more reliable than those for the previous year.

July 1, 1901, balance unexpended	$441,666.43
Amount appropriated by river and harbor act approved June 13, 1902	600,000.00
	1,041,666.43
June 30, 1902, amount expended during fiscal year	134,200.48
July 1, 1902, balance unexpended	907,465.95
July 1, 1902, outstanding liabilities	130,660.78
July 1, 1902, balance available	776,805.17
July 1, 1902, amount covered by uncompleted contracts	96,000.00
Amount (estimated) required for completion of existing project	4,710,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	800,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix H 25.)

17. Iron pier in Delaware Bay, near Lewes, Del.—[This work was in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, to June 12, 1902.] The original project for this work proposed the construction of a landing pier about 1,700 feet in length, extending from the shore south of the breakwater into Delaware Bay to a depth of 22 feet at mean low water, the pier to consist of a substructure of wrought-iron screw piles, surmounted by a timber superstructure. The work was commenced in 1871 and completed, except as to superstructure, in 1880.

The work done to June 30, 1890, resulted in the construction of 1,155 linear feet of pier 21 feet in width, and 546 linear feet 42 feet in width, or a total length of 1,701 feet. The depth of water at the outer end of the pierhead was about 21 feet at mean low water.

Since construction the pier has been repaired and cared for by the United States.

The total expenditure to June 30, 1902, was $385,339.40. Of this amount $27,000 was applied to the maintenance of the improvement.

The right to use the pier for railway purposes, granted in the act of July 15, 1870, has never been exercised and doubtless never will be, as the pier has not sufficient strength to support the weight of modern freight engines. It is therefore impossible to obtain any assistance from the railroad company in maintaining and repairing the structure.

During the past fiscal year no work has been in progress.

The pier is of great use for the purposes of the Government engineer, light-house, and quarantine services. It is of very great value to vessels frequenting the breakwater harbor in winter, when the harbor is packed with floating ice, rendering the anchorage dangerous. At such times vessels eagerly seek its shelter and protection.

It is proposed to hold the available balance of $820.60 for maintenance and repairs as needed.

The mean range of tide at the pier is 4.5 feet.

July 1, 1901, balance unexpended	$820.60
July 1, 1902, balance unexpended	820.60

(See Appendix H 26.)

18. Delaware breakwater, Delaware.—[This work was in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, to June 12, 1902.] The final report of the local officer upon this work was submitted June 19, 1899, and is printed in the Annual Report of the Chief of Engineers for 1899, page 1346.

The depths in the protected anchorage vary from 11½ to 18 feet at mean low water, and the harbor is available for vessels drawing up to about 16 feet.

The amount expended on this work up to June 30, 1902, was $2,807,479.06. No portion of this amount has been applied to maintenance.

During the past fiscal year a survey of the breakwater harbor was in progress as a part of a survey of the national harbor of refuge. The map of this survey has not yet been completed. During the year $9.93 was spent for blue prints and inspection.

The mean range of tide is 4.5 feet.

The Maritime Exchange of Philadelphia maintains a station on the breakwater, and through cables between the mainland and its station is in communication with the shipping of the harbor. Its reports state that during the year 1901 1,615 vessels, exclusive of tugs and fishing and small coasting craft, anchored under the protection of the breakwater.

It is proposed to reserve the available balance of $874.38 for repairs to the breakwater and for surveys and examinations of the work.

July 1, 1901, balance unexpended	$884.57
June 30, 1902, amount expended during fiscal year	9.93
July 1, 1902, balance unexpended	874.64
July 1, 1902, outstanding liabilities	.26
July 1, 1902, balance available	874.38

(See Appendix H 27.)

19. Harbor of refuge, Delaware Bay, Delaware.—[This work was in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, to June 12, 1902.] The project for the construction of this harbor, which was adopted and provided for on the continuous-contract system in the river and harbor act of June 3, 1896, includes the construction of a breakwater on the line of least depth along the eastern branch of the shoal known as the "Shears" and the construction of a row of ice piers across the upper end of the harbor to protect it from ice descending the bay, at a total cost not to exceed $4,665,000.

The act provides that in making the contracts the Secretary of War shall not obligate the Government to pay in any one fiscal year, beginning July 1, 1897, more than 25 per cent of the whole amount authorized to be expended.

No expenditures were made on this improvement previous to June 30, 1896.

Up to the close of the fiscal year ending June 30, 1902, $2,090,765.82 had been expended in the construction of the breakwater and ice piers. No part of this amount was applied to the maintenance of the work.

The breakwater was completed on December 11, 1901.

The superstructure of the breakwater has a length of 7,950 feet and the substructure a length of 8,040 feet measured on the low-water line.

A project for the construction of 10 ice piers was submitted on April 5, 1900, and approved April 23, 1900. This work was commenced during the fiscal year ending June 30, 1901, and is still in progress. Up to June 30, 1902, 65,169 tons of stone had been deposited in the ice piers under this project, thereby completing the substructures of all of them and the superstructures of three of them. Under date of June 7, 1902, a project was submitted for the construction of additional piers. This project has not yet been approved.

The funds on hand are considered sufficient for the completion of the work now projected.

The great value of this harbor to commerce is due to its location. It is about equidistant from New York, Philadelphia, and the capes of Chesapeake Bay (the ocean entrances to the ports of Baltimore, Norfolk, and Newport News), and is therefore an especially convenient point of call for the entire commerce of the North Atlantic coast. It is now largely used by vessels awaiting orders to ports for discharge or loading. During the year ending December 31, 1901, 1,615 vessels (not including small craft) called at this harbor.

By the construction of the breakwater the usefulness of this anchorage has been greatly increased, not only as a port of call, but also as a harbor of refuge. Vessels bound from northern to southern or from southern to northern ports are able to go to sea in doubtful weather with the assurance of finding ample protection at the Delaware capes if overtaken by storm.

Details as to this improvement may be found in Annual Report of the Chief of Engineers for 1897, page 1216. A map is printed in House Ex. Doc. No. 112, Fifty-second Congress, first session.

The mean range of tide is 4.5 feet.

July 1, 1901, balance unexpended	$438,420.91
June 30, 1902, amount expended during fiscal year	289,852.73
July 1, 1902, balance unexpended	148,568.18
July 1, 1902, outstanding liabilities	18,521.92
July 1, 1902, balance available	130,046.26
July 1, 1902, amount covered by uncompleted contracts	20,000.00

(See Appendix H 28.)

20. Removing sunken vessels or craft obstructing or endangering navigation—(*a*) *Wreck of canal boat John Hevron.*—This wreck was sunk in Arthur Kill, near Sewaren, N. J., and was a menace to navigation. It was reported on August 22, and its removal was authorized on August 24. The wreck was wholly removed on August 24, 1901, at a cost of $210.

(*b*) *Unknown wreck in Newark Bay.*—This wreck, which was afloat in the channel of Newark Bay, was reported on August 31, and was completely removed September 2, at a cost of $210, allotment of which was made September 4, 1901.

(*c*) *Unknown wreck in Raritan River, near New Brunswick.*—This wreck was carried down the river during the spring freshets and sunk in the channel a short distance below New Brunswick, and was a serious obstruction to navigation. Report was made on March 31, its approval was authorized April 2, and the wreck was removed on April 16, 1902, at a cost of $383.60.

(*d*) *Wreck of coal barge B. L. Collar in the Bronx River, New York.*—This wreck was sunk in the Bronx River, near the head of navigation, in such a manner as almost to block the channel. It was reported on June 21, estimate for its removal was submitted, and allotment made by the Department on June 25, 1902. Its removal has not yet been commenced.

(*e*) The following-named wrecks were also removed during the past fiscal year: The hydraulic dredge *Potomac*, sunk in the Delaware Breakwater Harbor; the three-masted schooner *Lavinia Campbell*, sunk in Delaware Bay; the canal boat *H. C. Webster*, foundered in the Upper Delaware River, at a point about 800 feet above the mouth of Pennypack Creek, and 500 feet off the Pennsylvania shore; the three-masted schooner *Lida Fowler*, sunk on the east side of the main ship channel in Delaware Bay in 21 feet of water, about 1½ miles above Fourteen Foot Bank light-house, and the bow compartment of the canal chunker *Beaver*, sunk in the Delaware River during a severe storm, alongside H. Disston & Co.'s bulkhead at Tacony.

(*f*) The removal of the wreck of the schooner *Lottie K. Friend* from Delaware Bay, under a contract dated February 18, 1897, with Thomas Poynter and Elijah D. Register, of Lewes, Del., in progress during the fiscal year ending June 30, 1897, was not completed, and the annulment of the contract was recommended June 16, 1898, and approved June 18, 1898. This wreck has not yet been removed.

The amount expended during the past fiscal year upon removal of wrecks is $5,276.25.

(See Appendix H 29.)

IMPROVEMENT OF ICE HARBOR AT MARCUSHOOK, PA., AND OF RIVERS AND HARBORS IN SOUTHERN NEW JERSEY AND IN DELAWARE; INLAND WATERWAY FROM CHINCOTEAGUE BAY TO DELAWARE BAY, VIRGINIA, MARYLAND, AND DELAWARE.

This district was in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, to October 1, 1901, and of Col. Jared A. Smith, Corps of Engineers, since that date, the officer in charge having under his immediate orders Capt. Spencer Cosby, Corps of Engineers, to September 4, 1901.

1. Ice harbor at Marcushook, Pa.—In 1785 the Commonwealth of Pennsylvania built two wharves upon crib piers at Marcushook for the convenience of commerce. In 1829 an appropriation was made by Congress for repairing the piers and improving the harbor.

In 1866 a project was adopted for a harbor in the Delaware River to protect vessels against moving ice. The old work at Marcushook was utilized as far as possible. The amount expended from 1866 to June 30, 1902, was $212,284.28. Since 1889 all expenditures have been for repairs and maintenance. The last amount appropriated for the work was $5,000, by act of September 19, 1890.

The harbor covers an area of 12 acres, of which about one-half has a depth of 12 to 18 feet and the other half 18 to 25 feet at mean low water.

The protection consists of the old landing piers and seven detached piers having superstructures of wooden cribs filled with stone and superstructures faced with cut stone.

The detached piers appear to be in good condition. The landing

piers are in bad condition, owing to decay and loss of material. It is now proposed to repair these piers at an estimated cost of $1,500.

The available balance is sufficient to serve all probable necessities for repairs for a considerable time.

July 1, 1901, balance unexpended	$1,715.72
July 1, 1902, balance unexpended	1,715.72
July 1, 1902, outstanding liabilities	1.52
July 1, 1902, balance available	1,714.20

(See Appendix I 1.)

2. Rancocas River, New Jersey.—The Rancocas River is a small tributary of the Delaware River, its mouth being about 11 miles above the Pennsylvania Railroad terminal and ferry at Camden, N. J.

In its original condition the minimum depth was 4½ feet at mean low water from the junction of the forks near Centerton to its mouth, a distance of 7½ miles. Above Centerton the depth on the Mount Holly Branch, a distance of 5½ miles, was generally about 2½ feet. From the forks to Moores Landing on the Lumberton Branch, a distance of 3.6 miles, the low-water depth over shoal places was 3 feet. The mean range of tides at Centerton, above mean low water, is about 5 feet.

The original project of 1881 proposed the formation, by a dike at Coates Bar and dredging elsewhere, of a channel from 150 to 200 feet wide and 6 feet deep at mean low water from the mouth to Centerton, and thence to Mount Holly a channel 5 feet deep.

Operations under this project were carried on from 1881 to 1885. To the close of the fiscal year ending June 30, 1895, operations had been directed to the formation of a low-water channel 100 feet wide and 6 feet deep from the mouth to Centerton, and 50 feet wide and 5 feet deep for a distance of about 1¾ miles above Centerton. The amount expended on this project was $37,500.30.

The appropriation of $2,000 for this river, made in the act of June 3, 1896, was required by the act to be expended in the improvement of the Lumberton Branch.

During the fiscal year ending June 30, 1898, the project was completed by dredging through the shoals at Pattersons Landing, below Paxsons Landing, and partly through the shoal above Paxsons Landing, the channel having a width of 30 feet and a mean low-water depth of 6 feet.

The river and harbor act of March 3, 1899, appropriated $2,000 for this river, to be expended in the Lumberton Branch.

During the fiscal year ending June 30, 1900, the project for the expenditure of this appropriation, which was approved April 8, 1899, was completed by dredging a channel with depth of from 6 to 7 feet at mean low water and a width of 30 feet through the shoal below Moores Landing.

The total expenditures upon this project to June 30, 1902, were $41,500.21.

No work has been done during the past fiscal year.

The expenditures thus far do not indicate that any permanent benefits can be obtained by dredging. The minimum low-water depths June 30, 1902, from the forks to the mouth of the river did not exceed

4 feet. On the Lumberton Branch, below Moores Landing, the minimum depth was 3½ feet. On the Mount Holly Branch the original conditions have not been perceptibly improved.

There is at present no definite project for the improvement of the main channel or its forks.

Most of the articles of freight received and shipped are such as would ordinarily be transported on very light-draft vessels and short distances only. The reduction of freight rates to result from an increase of depth would therefore be small and not at all commensurate with the cost.

The river and harbor act of June 13, 1902, appropriated $3,000 for continuing the improvement on the Lumberton Branch. The average annual receipts and shipments of freight reported for the years 1890 to 1894 were 237,928 tons, and for the years 1897 to 1901, 359,373 tons. In 1890 the receipts and shipments were reported to be 171,300 tons.

July 1, 1901, balance unexpended	[a] $399.70
Amount appropriated by river and harbor act approved June 13, 1902	[b] 3,000.00
July 1, 1902, balance unexpended	3,399.70

(See Appendix I 2.)

3. Cooper Creek, New Jersey.—This creek flows in a northwesterly direction in Camden County, N. J., and empties into the Delaware River at Camden, a short distance above Cooper Point. The creek is navigable at mean high water for a distance of 5 miles from its mouth for vessels drawing 11½ feet, and for a further distance of 4 miles for vessels drawing 5 feet. The mean range of tides at the mouth is 6 feet. For a distance of 1½ miles from the mouth the width of the stream averages about 80 feet at low water and about 120 feet between the banks, and the channel in its original condition had a depth at mean high water of from 12 to 15 feet, except at one place where the depth was 9½ feet.

The project for this improvement was adopted in the river and harbor act of June 3, 1896, and is printed in the Annual Report of the Chief of Engineers for 1895, page 1102. It provides for the formation by dredging of a channel 70 feet wide at bottom and 18 feet deep at mean high water from the mouth of the creek to Browning's Chemical Works, and a channel of the same dimensions through the bar just outside the mouth, in all a distance of about 9,000 feet. The estimated cost, including contingencies, is $35,000.

The river and harbor act of June 3, 1896, appropriated $37,000 for completing this improvement, of which $2,500, or so much thereof as might be necessary, was to be expended in rebuilding the dike on the Government reservation in the Delaware River at Woodbury Creek.

The amount expended on this project to June 30, 1902, was $28,176.10.

The dredging resulted in the formation of a channel extending from the mouth to the Camden Iron Works, 7,500 feet long, 50 to 70 feet wide, except at the bridges, where the widths are 30 feet, and 18 feet deep at mean high water, except on the water pipe belonging to the city of Camden, where the high-water depths are 14 to 15 feet.

During the past fiscal year no work was done upon the improvement.

[a] Pertains to Mount Holly Branch. [b] For Lumberton Branch

The channels thus far dredged appear to have been fairly well maintained.

The city of Camden has a water main crossing Cooper Creek at State street, which is practically at the mouth, because below that point the adjacent land on both sides is swampy and covered at high water. This crossing is less than half a mile from the contour of 12 feet depth in the Delaware River. The low-water depth over the water pipe is but 9 feet, which necessarily limits the draft of vessels entering and leaving the stream, irrespective of improvements to a greater depth.

It is proposed to complete the improvement with funds now available as soon as the city removes, or sufficiently lowers, the water pipe.

The commerce of Cooper Creek is considerable, and consists largely of coal, sand, and stone. The average annual receipts and shipments of freight during years from 1895 to 1901 were 308,250 tons. For 1901 the receipts and shipments are reported to have been 726,888 tons.

July 1, 1901, balance unexpended	$8,823.90
July 1, 1902, balance unexpended	8,823.90

(See Appendix I 3.)

4. Mantua Creek, New Jersey.—The Mantua Creek is a small stream flowing into the Delaware River at a point about 10 miles below the terminal and ferry of the Pennsylvania Railroad at Camden, N. J.

In its original condition it was navigable at high water for a distance of one-half mile above its mouth to the phosphate works of the I. P. Thomas & Sons Company for vessels of 13 feet draft; thence 3¼ miles farther to Paulsboro for vessels drawing 9 feet; thence 3¼ miles to Parkers Landing for tugs and barges drawing 6 feet, this being the head of steam navigation; thence 4.1 miles to Mantua, 11¼ miles above the mouth, small boats and barges of 3 to 4 feet draft passed up on the tide. The navigable portion is generally bordered by low ground, protected from overflow by earthen banks. The general course of the stream is tortuous, and its navigation is much obstructed by bars, sharp bends, and the upper portion by stumps and overhanging trees. The stream, on account of its flat watershed, is subject to only moderate freshets, which seldom exceed 2 to 3 feet above tide water. The range of tide is 6 feet at the mouth, 4.5 feet at Paulsboro, 3.4 feet at Berkley, and 2 feet at Mantua.

The low-water width near the mouth averages 160 feet, decreasing to about 100 feet at Paulsboro. Above Paulsboro the width decreases to 88 feet at Parkers Landing and near Mantua to 50 feet.

The approved project for the improvement, which was adopted by Congress in river and harbor act of March 3, 1899, contemplates the dredging of a channel 100 feet wide on the bottom and 12 feet deep from the Delaware River through the marsh to the phosphate works, a distance of 2,200 feet; thence 80 feet wide on the bottom and 8 feet deep to Paulsboro, 6,300 feet, making a channel nearly direct by cutting off three bends; thence to Parkers Landing near Berkley, 3 miles, with one cut-off 60 feet wide and 7 feet deep; and the dredging of a cut-off 350 feet long, 50 feet wide, and 3 feet deep, 9,000 feet above Berkley; also the removal of overhanging trees above Berkley and the construction of jetties on both sides at the mouth of the creek.

The estimated cost of this improvement was $145,030. Such land and rights as were considered necessary for the cut-offs were purchased in September, 1900, at a cost of $8,000.

Previous to June 30, 1902, the amount expended on this improvement, including land purchased, was $27,872.34, of which $24,868.34 was on the present project.

As a result the channel between the phosphate works and Paulsboro was completed as planned, with three cut-offs. Latest reports indicate that the dredged channels have been fully maintained.

No work of improvement has been in progress during the past fiscal year. The small amount expended was for maintenance of bank of channel at the lower cut-off.

The river and harbor act of June 13, 1902, appropriated $35,000 for continuing the improvement. It is proposed to expend this sum in dredging a channel from the Delaware River to the phosphate works and in constructing jetties for preservation of the channel at the mouth of the creek.

Most of the freight carried in and out of this creek is of a kind which would generally be carried upon small vessels of light draft. The total of freights to and from all points in the creek in 1901 was 202,703 tons.

July 1, 1901, balance unexpended	$152.27
Amount appropriated by river and harbor act approved June 13, 1902	35,000.00
	35,152.27
June 30, 1902, amount expended during fiscal year	24.61
July 1, 1902, balance unexpended	35,127.66

(See Appendix I 4.)

5. Alloway Creek, New Jersey.—This is a small tributary of the Delaware River, flowing westerly in the southwestern part of New Jersey, its mouth being about 50 miles below Camden, N. J.

In its original condition Alloway Creek was obstructed between its mouth and Quinton, a distance of about 10 miles, by shoal areas in the upper half of the stream, which reduced the low-water depths to from 1.3 to 4 feet. The original project of 1889 proposed the dredging of a channel 6 feet deep at mean low water and 60 feet wide from Quinton to a point about 1,000 feet above Upper Hancock Bridge; thence a channel of the same depth and 75 feet wide to a locality known as the "Square," where the work is to be supplemented by a dike. At a locality known as the "Canal," in addition to a channel of the last-named dimensions, the width of the stream was to be increased to about 150 feet between the low-water lines. The project was modified on December 10, 1896, so as to provide for a dike formed by a single row of piles above Upper Hancock Bridge. This modification does not increase the original estimated cost of the work, which is $25,000.

The total expenditure on this project to June 30, 1902, including $1,200 for maintenance of dredged channels, was $18,000.

As a result, channels have been dredged from 40 to 75 feet wide and 6 feet deep through shoal places; below the Square, at the Square, at "Smith Reeves," at and near the Canal, just below Upper Hancock Bridge, from Upper Hancock Bridge to a distance of 1,400 feet, above and below Robinsons Landing, Upper and Lower Fowsers, Upper and Lower Lamberts, and Quinton; and dikes 300 and 404 feet in length had been constructed at the Square and above Upper Hancock Bridge, respectively.

No work of improvement was done in the past fiscal year.

The maximum draft which could be carried over the shoals at low water June 30, 1902, was 3½ feet.

The river and harbor act of June 13, 1902, appropriated $3,000 for continuing the improvement.

It will require the expenditure of the entire amount appropriated to restore and maintain channels previously dredged.

The shipments from this creek in 1901 were reported to amount to 19,125 tons and the receipts 44,500 tons. The shipments consist of canned goods, glassware, produce, timber, etc. The receipts are articles for local manufacturers and consumers. To what extent freight rates have been reduced by the improvements can not be definitely stated.

Amount appropriated by river and harbor act approved June 13, 1902...	$3,000.00
July 1, 1902, balance unexpended	3,000.00
July 1, 1902, outstanding liabilities	4.95
July 1, 1902, balance available	2,995.05

(See Appendix I 5.)

6. Goshen Creek, New Jersey.—This is a very small creek in the southern part of the State; it flows in a northwesterly course into the Delaware Bay at a point about 16 miles north of Cape May. The navigable portion is near the mouth, where it is subject to ebb and flow of tides from the bay.

In its original condition Goshen Creek carried a low-water depth of from 2 to 4 feet, with a least low-water width of 20 feet and a high-water width of 36 feet from Goshen to a point about 4,000 feet below, and thence to the mouth, a distance of about 2,500 feet, a low-water depth of from 3 to 5 feet, with a least width of 30 feet.

The project for its improvement, adopted in 1891, proposed the deepening and widening by dredging of the 4,000 feet of the creek below Goshen Landing to a low-water depth of 3 feet and a width of 30 feet; the formation of a dredged channel 3 feet deep and about 50 feet wide through the bar at the mouth to the limit of the sand beyond the low-water line, and the protection of the channel by a sheet-pile jetty.

During the fiscal year ending June 30, 1898, an estimate for the completion of the project, based on a careful survey of existing conditions, was made. In order to maintain the dredged channel it was found necessary to extend the dike somewhat farther inshore and dredge through the bar at the mouth of the creek, which increased the cost of the project from $12,000, as originally estimated, to $17,000.

The river and harbor act of March 3, 1899, appropriated $8,000 for the completion of this improvement. During the fiscal year ending June 30, 1899, a project for the expenditure of this sum and of a balance remaining from a previous appropriation was submitted and approved. The project provides for dredging a channel with a low-water depth of 3 feet entirely through the mouth of the creek, and for repairing and extending the existing dike and constructing a shore dike on the upper side of the mouth of the creek. Work under this project was commenced during the fiscal year ending June 30, 1899, and was completed in the year ending June 30, 1900, leaving an unexpended balance of $841.72, which has been held for necessary examinations and repairs.

The amount expended on this improvement to June 30, 1902, was $16,159.78.

No work of improvement was done in the past fiscal year.

The commerce of the creek is very small.

July 1, 1901, balance unexpended	$841.72
June 30, 1902, amount expended during fiscal year	1.50
July 1, 1902, balance unexpended	840.22

(See Appendix I 6.)

7. Tuckerton Creek, New Jersey.—This is a small tidal creek flowing into Little Egg Harbor on the Atlantic coast northeast of Atlantic City. A preliminary examination and survey of the creek were made, and a report recommending its improvement, with estimate of cost, was submitted to Congress and printed in House Doc. No. 274, Fifty-sixth Congress, first session; also in Annual Report of the Chief of Engineers for 1900, pages 1612–1615.

The present low-water depth at Tuckerton is 15 inches, which increases gradually to 4 feet at the mouth of the creek, a distance of 2 miles. From the mouth of the creek across the flats to Gaunts Point, three-fourths of a mile, the low-water depths are 2 to 2½ feet. The mean tidal range is 2½ feet.

It is proposed to dredge a channel 5 feet deep and 75 feet wide from the upper landing to the lower landing, about a quarter of a mile below, and thence a depth of 6 feet to Gaunts Point, and to construct a dike on north side of channel opposite Tuckerton Cove.

The estimated cost of the improvement is $61,380.

The river and harbor act of June 13, 1902, appropriated $12,000 for improving Tuckerton Creek, in accordance with the project contained in the aforementioned document.

Amount appropriated by river and harbor act approved June 13, 1902	$12,000.00
July 1, 1902, balance unexpended	12,000.00

(See Appendix I 7.)

8. Raccoon Creek, New Jersey.—This creek rises in Gloucester County, flows in a northwesterly direction, and empties into the Delaware River at a point nearly opposite Marcushook, Pa. A preliminary examination and survey of Raccoon Creek was made in 1899, and a report, with estimate of cost of improvement, was submitted to the Secretary of War under date of December 18, 1899, and printed in House Doc. No. 231, Fifty-sixth Congress, first session; also on pages 1590 to 1598, Annual Report of the Chief of Engineers for 1900.

It is navigable at high water for a distance of 1¾ miles above its mouth to Bridgeport for vessels of 9 feet draft; thence 3¼ miles farther to Springer's wharf for vessels drawing 7 feet, and thence 4¾ miles to Swedesboro, the head of steam navigation, for boats and barges having a draft of 4 feet. Above Swedesboro the stream is narrow, shoal, and very crooked.

The navigable portion, when it leaves fast land, winds through meadows lying 2 or 3 feet above low water, which, except for the 2 miles immediately below Swedesboro, are generally protected from overflow by revetted earthen banks.

Navigation is much obstructed by bars and a few sharp bends.

The average of tide at the confluence with the Delaware River is 6 feet; at Bridgeport, 1¾ miles above the mouth, it is also 6 feet; at Kirbys Landing, 3 miles above the mouth, 5.8 feet; at Davenport's wharf, 4½ miles from the mouth, 5.6 feet; at Leap's wharf, 5¾ miles from the mouth, 5.6 feet; at Adolph Black's wharf, 7¾ miles above the mouth, 5.3 feet, while at Swedesboro it is 4.9 feet, though at the latter place it is considerably influenced by winds and freshets.

The project of improvement is to dredge a channel 7 feet deep at mean low water and 75 feet wide to Bridgeport, 1¾ miles from the mouth; thence 60 feet wide to Springer's wharf, 5 miles from the mouth; thence 5 feet deep and 40 feet wide to head of navigation at Swedesboro, 9¾ miles from the mouth.

The estimate includes dredging 371,400 cubic yards of material, at a total cost of $102,135.

The river and harbor act of June 13, 1902, appropriated $15,000 for improving the creek in accordance with the report contained in the aforementioned document.

Amount appropriated by river and harbor act approved June 13, 1902.. $15,000.00
July 1, 1902, balance unexpended 15,000.00

(See Appendix I 8.)

9. Wilmington Harbor, Delaware.—The harbor of Wilmington, Del., is in the Christiana River, and includes a length of about 4 miles above its mouth at the Delaware River. It also includes the navigable portion of the Brandywine River, which flows into the Christiana River at a point about 1¾ miles above its mouth.

Previous to 1836, when the first appropriation for the improvement of the Christiana River was made, the low-water depth at the entrance to this stream was about 8½ feet. The minimum depth in the channel in the portion of the river below Third Street Bridge, Wilmington, was 8 feet. This depth was increased in 1836 by dredging to 10 feet below low water.

A history of this improvement under various projects is given on pages 246 to 249, Annual Report of the Chief of Engineers for 1901.

Under provisions of the river and harbor act of June 3, 1896, the latest project for a channel of 21 feet depth from the mouth to the pulp works, a distance of 4 miles, was adopted.

The river and harbor act of March 3, 1899, appropriated $45,000, and authorized contracts for completing the project.

The total expenditures for this improvement from 1836 to June 30, 1902, were $842,442.62.

Of this amount there had been expended since 1896 upon the project for a channel 21 feet deep $440,247.84.

No work of improvement has been in progress during the past fiscal year.

June 30, 1902, the channel depths below the mouth of the Brandywine River generally ranged from 15 feet to 20 feet, with a few isolated places where depths were 21 feet or more. At the pulp works the depths were 10 to 12 feet, and thence down to the Brandywine River mid-channel depths ranged from 12 to 18 feet.

The rapid shoaling of this channel indicates that the project depth of 21 feet at mean low water can not be maintained under present conditions at any reasonable cost.

The river and harbor act of June 13, 1902, appropriated $50,000, with the proviso that not more than $25,000 of the amount shall be expended

The amount expended on this improvement to June 30, 1902, was $16,159.78.

No work of improvement was done in the past fiscal year.

The commerce of the creek is very small.

July 1, 1901, balance unexpended	$841.72
June 30, 1902, amount expended during fiscal year	1.50
July 1, 1902, balance unexpended	840.22

(See Appendix I 6.)

7. Tuckerton Creek, New Jersey.—This is a small tidal creek flowing into Little Egg Harbor on the Atlantic coast northeast of Atlantic City. A preliminary examination and survey of the creek were made, and a report recommending its improvement, with estimate of cost, was submitted to Congress and printed in House Doc. No. 274, Fifty-sixth Congress, first session; also in Annual Report of the Chief of Engineers for 1900, pages 1612–1615.

The present low-water depth at Tuckerton is 15 inches, which increases gradually to 4 feet at the mouth of the creek, a distance of 2 miles. From the mouth of the creek across the flats to Gaunts Point, three-fourths of a mile, the low-water depths are 2 to 2½ feet. The mean tidal range is 2½ feet.

It is proposed to dredge a channel 5 feet deep and 75 feet wide from the upper landing to the lower landing, about a quarter of a mile below, and thence a depth of 6 feet to Gaunts Point, and to construct a dike on north side of channel opposite Tuckerton Cove.

The estimated cost of the improvement is $61,380.

The river and harbor act of June 13, 1902, appropriated $12,000 for improving Tuckerton Creek, in accordance with the project contained in the aforementioned document.

Amount appropriated by river and harbor act approved June 13, 1902	$12,000.00
July 1, 1902, balance unexpended	12,000.00

(See Appendix I 7.)

8. Raccoon Creek, New Jersey.—This creek rises in Gloucester County, flows in a northwesterly direction, and empties into the Delaware River at a point nearly opposite Marcushook, Pa. A preliminary examination and survey of Raccoon Creek was made in 1899, and a report, with estimate of cost of improvement, was submitted to the Secretary of War under date of December 18, 1899, and printed in House Doc. No. 231, Fifty-sixth Congress, first session; also on pages 1590 to 1598, Annual Report of the Chief of Engineers for 1900.

It is navigable at high water for a distance of 1¾ miles above its mouth to Bridgeport for vessels of 9 feet draft; thence 3¼ miles farther to Springer's wharf for vessels drawing 7 feet, and thence 4¾ miles to Swedesboro, the head of steam navigation, for boats and barges having a draft of 4 feet. Above Swedesboro the stream is narrow, shoal, and very crooked.

The navigable portion, when it leaves fast land, winds through meadows lying 2 or 3 feet above low water, which, except for the 2 miles immediately below Swedesboro, are generally protected from overflow by revetted earthen banks.

Navigation is much obstructed by bars and a few sharp bends.

The average of tide at the confluence with the Delaware River is 6 feet; at Bridgeport, 1¾ miles above the mouth, it is also 6 feet; at Kirbys Landing, 3 miles above the mouth, 5.8 feet; at Davenport's wharf, 4½ miles from the mouth, 5.6 feet; at Leap's wharf, 5¾ miles from the mouth, 5.6 feet; at Adolph Black's wharf, 7¾ miles above the mouth, 5.3 feet, while at Swedesboro it is 4.9 feet, though at the latter place it is considerably influenced by winds and freshets.

The project of improvement is to dredge a channel 7 feet deep at mean low water and 75 feet wide to Bridgeport, 1¾ miles from the mouth; thence 60 feet wide to Springer's wharf, 5 miles from the mouth; thence 5 feet deep and 40 feet wide to head of navigation at Swedesboro, 9¾ miles from the mouth.

The estimate includes dredging 371,400 cubic yards of material, at a total cost of $102,135.

The river and harbor act of June 13, 1902, appropriated $15,000 for improving the creek in accordance with the report contained in the aforementioned document.

Amount appropriated by river and harbor act approved June 13, 1902.. $15,000.00
July 1, 1902, balance unexpended 15,000.00

(See Appendix I 8.)

9. Wilmington Harbor, Delaware.—The harbor of Wilmington, Del., is in the Christiana River, and includes a length of about 4 miles above its mouth at the Delaware River. It also includes the navigable portion of the Brandywine River, which flows into the Christiana River at a point about 1¾ miles above its mouth.

Previous to 1836, when the first appropriation for the improvement of the Christiana River was made, the low-water depth at the entrance to this stream was about 8½ feet. The minimum depth in the channel in the portion of the river below Third Street Bridge, Wilmington, was 8 feet. This depth was increased in 1836 by dredging to 10 feet below low water.

A history of this improvement under various projects is given on pages 246 to 249, Annual Report of the Chief of Engineers for 1901.

Under provisions of the river and harbor act of June 3, 1896, the latest project for a channel of 21 feet depth from the mouth to the pulp works, a distance of 4 miles, was adopted.

The river and harbor act of March 3, 1899, appropriated $45,000, and authorized contracts for completing the project.

The total expenditures for this improvement from 1836 to June 30, 1902, were $842,442.62.

Of this amount there had been expended since 1896 upon the project for a channel 21 feet deep $440,247.84.

No work of improvement has been in progress during the past fiscal year.

June 30, 1902, the channel depths below the mouth of the Brandywine River generally ranged from 15 feet to 20 feet, with a few isolated places where depths were 21 feet or more. At the pulp works the depths were 10 to 12 feet, and thence down to the Brandywine River mid-channel depths ranged from 12 to 18 feet.

The rapid shoaling of this channel indicates that the project depth of 21 feet at mean low water can not be maintained under present conditions at any reasonable cost.

The river and harbor act of June 13, 1902, appropriated $50,000, with the proviso that not more than $25,000 of the amount shall be expended

until arrangements have been made by the city of Wilmington, and approved by the Secretary of War, to dispose of the sewage from the city "in such manner as to prevent the filling of the channel and the largely increased cost of maintenance caused thereby."

The average annual receipts and shipments of freight reported for the years 1895 to 1901 were 920,373 tons.

July 1, 1901, balance unexpended	$65,193.13
Amount appropriated by river and harbor act approved June 13, 1902	50,000.00
Taken up on account of erroneous payments	56.66
	115,249.79
June 30, 1902, amount expended during fiscal year	54,595.19
July 1, 1902, balance unexpended	60,654.60
July 1, 1902, outstanding liabilities	8,022.50
July 1, 1902, balance available	52,632.10

(See Appendix I 9.)

10. Appoquinimink, Murderkill, and Mispillion rivers, Delaware.—(*a*) *Appoquinimink River.*—This is a small tidal stream flowing eastwardly into the Delaware River at a point 20 miles south of Wilmington, Del. The approved project is based upon the results of a survey made in 1889, when the mean low-water depth at the mouth of the river was but 2 feet, and the shoalest depth inside was 4½ feet. The most serious obstructions to navigation were the many bends in the lower and middle sections.

The project provides for a channel 8 feet deep at mean low water having a width of 80 feet from the bridge at Odessa to near Townsend's wharf, a distance of 3¼ miles, and thence to the mouth of the river a width of 100 feet, a distance of 5 miles. The estimated cost of the improvement was $39,963.

The amount expended upon this improvement to June 30, 1902, was $24,912.07.

The resulting depth over the shoalest part of the river was 5½ feet. The full width has not been obtained. A history of the work done is given on page 351, Annual Report of the Chief of Engineers for 1901.

No work was done on the improvement in the past fiscal year.

At the close of the fiscal year, June 30, 1902, the low-water depth over the bar at the mouth was 2½ feet, and thence to Odessa it probably exceeds 7 feet in a narrow channel.

The average annual receipts and shipments of freight reported from 1893 to 1901 were 23,432 tons. In 1890, in which year the project was adopted, the receipts and shipments reported were 19,132 tons

(*b*) *Murderkill River.*—This is a small tidal stream flowing northeastwardly into Delaware Bay, about 52 miles south of Wilmington, Del. Its navigable portion is about 9 miles long. At the time of the adoption of the present project in 1892, the flats opposite the mouth of the river were covered to a depth of about 2 feet at low water for nearly a mile from shore. The average width of the river was 90 feet, and the average depth 6 feet; average tides, 4.5 feet.

Under the provisions of the river and harbor act of July 13, 1892, a project was adopted with a view to obtaining a channel 7 feet deep and 80 feet wide at low water from Frederica, at the head of navigation, to the mouth of the river, and thence 150 feet wide and 7 feet deep across the flats to the deep water of Delaware Bay.

The estimated cost of completing the project was $47,550.

The amount expended upon the project to June 30, 1902, was $23,360.78. The sum of $1,500 from the appropriation of August 18, 1894, was expended in removing shoal at mouth of St. Jones River.

No work was done during the past fiscal year.

At the end of the fiscal year June 30, 1902, the channel across the flats had nearly disappeared, a slight depression only being found. The low-water depth was about 2 feet. It is evident that a channel can not be maintained across the flats unless it be protected by jetties of some material which will be permanent.

(*c*) *Mispillion River.*—This is a small tidal stream flowing easterly into Delaware Bay nearly opposite Cape May and about 17 miles northwest of Cape Henlopen.

It is navigable for more than 14 miles. The mouth of the river is greatly obstructed by very wide flats over which vessels can enter and depart only at high water, the tidal range being about 4.5 feet.

The river from Milford to the mouth was improved by the General Government between the years 1879 and 1889, and $17,000 was expended in making a channel 40 feet wide and 6 feet deep at mean low water.

The present project for the improvement at the mouth of the river provides for a cut across the flats in a southeasterly direction, having a width of 150 feet and a depth of 6 feet at mean low water, beginning opposite the light-house and ending in deep water in the bay, the cut to be protected on the upper or north side by a bank made of the excavated material. The estimated cost was $24,000.

The amount expended to June 30, 1902, was $42,360.37, of which $25,356.75 was applied on the project of 1891.

No work of improvement was carried on during the past fiscal year.

June 30, 1902, there was very little trace of a channel across the bar, and a sand point at the mouth of the river had gradually extended so as to nearly close the channel. Above that point conditions have remained essentially the same.

Under the provisions of the emergency river and harbor act of June 6, 1900, a preliminary examination and survey of this stream were made from the 6-foot curve in Delaware Bay to the head of navigation at Walnut Street Bridge, Milford, a distance of 14.4 miles, and reports thereon are printed in the Annual Report of the Chief of Engineers for 1901, page 1365.

The river and harbor act of June 13, 1902, appropriated $15,000 for maintenance of the channels of the Appoquinimink, Murderkill, and Mispillion rivers. The freight carried on the Appoquinimink River is reported as being 25,075 tons, that on the Murderkill a little more than one-half that amount, and that on the Mispillion River four and one-half times as much.

July 1, 1901, balance unexpended		$420.40
Amount appropriated by river and harbor act approved June 13, 1902		15,000.00
		15,420.40
June 30, 1902, amount expended during fiscal year	$3.62	
June 30, 1902, amount returned to Treasury to credit of appropriation for emergencies in rivers and harbors, act June 6, 1900	27.68	
		31.30
July 1, 1902, balance unexpended		15,389.10

(See Appendixes I 10–12.)

11. Symrna River.—This river was formerly known as Duck Creek; it is a small tidal stream flowing easterly into the Delaware River at a point about 26 miles south of Wilmington, Del. The navigable portion of the river was originally about 9 miles long; the minimum mean low-water depth over shoal places was 2½ feet in the river and 4 feet at the bar where it enters the Delaware River. The mean range of the tide at the mouth is nearly 6 feet.

In 1878 a project was made for the improvement of the whole river, including the channel across the bar at the mouth.

By direction of Congress the improvement of the bar was commenced first, and during the following four years three appropriations, aggregating $10,000, were expended in dredging a channel 100 feet wide and 8 feet deep at mean low water across the bar. The dredged channel soon filled up again.

A new project was adopted in 1887 with a view of obtaining a channel of 7-foot depth throughout, with a width of 60 feet in the river and 100 feet at the bar; the channel over the bar to be protected by a stone jetty. The estimated cost of the improvement was $90,698.40. The first appropriation for work on this project was in 1888, and was for dredging. The subsequent appropriations for continuing the improvement have also been applied to dredging.

The total expenditures to June 30, 1902, were	$42,747.54
Total upon project of 1887	32,747.54

The dredging originally contemplated had been completed, except the shoal at the mouth of the river.

No work of improvement was done in the past fiscal year.

Under the provisions of the emergency river and harbor act of June 6, 1900, a preliminary examination and survey were made with a view to securing 2 crosscuts to shorten the distance between the head of navigation on this river and Delaware Bay. The report on the survey is printed in House Doc. No. 90, Fifty-sixth Congress, second session, and on pages 1363–64, Annual Report of the Chief of Engineers for 1901. It recommends the construction of 2 cut-offs 60 feet wide and 7 feet deep at mean low water—one 2,445 feet long, extending from the turn just below Limekiln wharf to the turn just above Mill Creek; the other 2,200 feet long, extending from below Rothwells Landing to the turn between Deep Hole and Brick Store Landing. The cost of work was estimated at $15,000.

The river and harbor act of June 13, 1902, appropriated $15,000 for improving Smyrna River in accordance with the report above mentioned, with the proviso "that no part of said amount shall be expended until a satisfactory title of the land required for crosscuts and other portions of this improvement shall be obtained without expense to the Government."

The freight tonnage for 1901 was somewhat less than in 1900, but the general tendency to an increase during ten years is very marked.

July 1, 1901, balance unexpended	$252.46
Amount appropriated by river and harbor act approved June 13, 1902	15,000.00
July 1, 1902, balance unexpended	15,252.46

(See Appendix I 13.)

12. Island waterway from Chincoteague Bay, Virginia, to Delaware Bay, at or near Lewes, Del.—The original project, based on a survey

made in 1884, contemplated the construction of a continuous waterway 70 feet wide and 6 feet deep at mean low water from Chincoteague Inlet at the southwesterly end of Chincoteague Bay, Virginia, to Delaware Bay, at or near Lewes, Del. The entire length of the proposed channel is nearly 73 miles, of which about 57 miles is through several shallow interior bays separated from the Atlantic Ocean by narrow strips of sandy beach and soil; the remaining 16 miles to consist mainly of canals to be formed by dredging.

The estimated cost was $350,000.

In 1892 the line of location was slightly modified and the proposed dimensions of the canal were reduced from a width of 70 feet to 20 feet on the bottom. The estimated cost from Rehoboth Bay to Delaware Bay was reduced to $241,224. This, however, supposed that the work would be done in about two years in one large contract.

A cut has been made 4 miles long, 20 feet wide at bottom, and 4 feet deep below the mean level of Assawaman Bay across the neck of land lying between Little Assawaman Bay and Whites Creek, a tributary of Indian River Bay, and three temporary wooden bridges built over it. A cut 20 feet wide and 6 feet deep below datum (mean low water of Rehoboth Bay) has been made from that depth in Rehoboth Bay to a point 1,250 feet south of the Delaware, Maryland and Virginia Railroad crossing at Rehoboth, a distance of 9,000 feet; and another cut, in continuation of this, extending to the railroad reservation, a distance of 1,125 feet, has been made to a depth of 2 feet below mean low-water level; and north of the railroad crossing a cut was made to a point 1,000 feet north of the boundary of the railroad track. Of this latter distance, the lower 800 feet was excavated to a depth of 9½ feet and the remaining 200 feet to an average depth of 15 feet above datum, the depth of cutting in the first averaging approximately 17½ feet, and in the latter about 8 feet. The cut between Assawaman Bay and Whites Creek was made and the three bridges built in 1891. The remainder of the work described was done between 1893 and February, 1896.

The amount expended on the project to June 30, 1902, was $168,421.88, no portion of this amount having been applied to maintenance, and the condition of the work between Ocean View and Rehoboth when last examined, in June, 1901, was as follows: The cut made between Whites Creek and the head of Little Assawaman Bay to a depth of 4 feet had shoaled in the middle portion, the depths there being about 2½ feet. These shoals are formed where the sandy side slopes, bare of all vegetation, fall in considerably during heavy rains. The depths in the cut through low or marsh ground had maintained themselves very well. The cut made to a depth of 6 feet from Rehoboth Bay along Millers Creek toward the high ground back of Rehoboth during the working season of 1894 was in fair condition except for the closing of the entrance to the canal by the formation of a bar in line with the bay shore.

The river and harbor act of June 3, 1896, appropriated $25,000 for continuing this improvement, to be used between Delaware Bay and Indian River; but provided that no part of the appropriation should be expended till the right of way should be secured without cost to the United States. The right of way over or through any railroad or county bridge was, however, not subjected to the proviso, but might be secured by condemnation proceedings. Previous to the passage of

this act deeds to the land covering the entire right of way had been vested in the United States, with the exception of that portion crossing the Delaware, Maryland and Virginia Railroad at Rehoboth.

In January, 1899, the commissioners of Rehoboth conveyed to the United States a quitclaim deed to whatever title that corporation had to the land at the railroad crossing. The railroad, however, held the right of way by a franchise from the State.

In May, 1899, the commissioners for condemnation of the right of way of the Delaware, Maryland, and Virginia Railroad Company at at Rehoboth awarded the sum of $37,343.58 to the railroad company as being in full for all damages to them and for the erection and maintenance of a bridge across the waterway. No funds have thus far been made available for the payment of this award. No action has therefore been taken toward the construction of the bridge by the railroad company.

The proviso restricting the expenditure of the appropriation of June 3, 1896, having been construed by the law officers of the Department to apply only to that portion of the right of way secured without cost to the United States, the unexpended funds were held to be available for work under the existing project, and in April, 1902, a contract was awarded for jetty construction and dredging to restore channel depths. Work under the contract had not been commenced at the end of the fiscal year.

The expenditures of the past fiscal year were for necessary surveys, advertising, etc., preliminary to commencing work under contract.

No commerce of sufficient amount for consideration was reported for the fiscal year ending June 30, 1901.

The ultimate cost of making this a route for any considerable commerce is believed to be greatly in excess of the probable benefits in freight rates.

July 1, 1901, balance unexpended	$26,044.94
June 30, 1902, amount expended during fiscal year	716.82
July 1, 1902, balance unexpended	25,328.12
July 1, 1902, outstanding liabilities	188.06
July 1, 1902, balance available	25,140.06
July 1, 1902, amount covered by uncompleted contracts	22,500.00

(See Appendix I 14.)

13. Removing sunken vessels or craft obstructing or endangering navigation.—During the past fiscal year wrecks were removed as follows: Canal boat *Zeus*, from Smyrna River, Delaware; lighter No. 33, from Schuylkill River, Pennsylvania; bow box of hinged barge *Sunflower*, from Chester River, Pennsylvania; schooner *Melvina*, from Mahon River, Delaware; and canal boat *Peter A. Rogers*, from Schuylkill River, Pennsylvania.

Examinations of two wrecks have been made and examinations of three more have been ordered.

The amount expended for the examination and removal of wrecks during the year was $2,719.85.

(See Appendix I 15.)

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN MARYLAND TRIBUTARY TO CHESAPEAKE BAY, AND OF BROAD CREEK AND NANTICOKE RIVERS, DELAWARE AND MARYLAND.

This district was in the charge of Lieut. Col. O. H. Ernst, Corps of Engineers, to July 31, 1901, and of Col. Peter C. Hains, Corps of Engineers, since that date.

1. Elk River, Maryland.—Before improvements were commenced there was practically no navigation above Cedar Point. The original project, dated July 17, 1874, was for a channel 6 feet deep at low water, or 8 feet at high water, from Cedar Point to Elkton, and in the Little Elk as far as Bennett's wharf. The mean range of the tide is 2 feet. Such a channel was estimated to cost $36,000 if 75 feet wide, and about $25,000 if 50 feet wide, cheap dikes being required for regulating the banks, and to provide a place behind which to deposit the material dredged from the shoals. The first work was done in 1874, when $5,000 was expended in building a dike and dredging to a width of 25 feet and a depth of 6 feet at mean low water in front of it and for about 300 feet below. Two years later the channel was made 40 feet wide from the bridge at Elkton to about one-half mile below. In 1884 a channel was completed 80 feet wide through the bar near the mouth of the Little Elk River, and 70 feet wide thence to the bridge at Elkton, the depth being 7 feet at mean low water. In 1893 a channel 100 feet wide and 8 feet deep from deep water below Cedar Point to the bridge at Elkton was completed. The expenditure on the original and following projects has amounted to $46,500. The channel has shoaled, and in the report on the survey of 1899 it is proposed to restore the channel to 8 feet deep at mean low water, and 100 feet wide, at an estimated cost of $16,665, with an annual cost of $2,500 for maintenance. The river and harbor law of June 13, 1902, appropriates $16,665 for this river. The tonnage of the river for 1901 is reported to be 20,437. Two tugboats of 6½ and 7½ feet draft, and 163 vessels of an aggregate tonnage of 61,125 and a greatest draft of 8½, feet are reported as trading on the river. Two boat yards are engaged in building barges.

References.

Subject.	When made.	Document.	Annual report.
Survey	1873		1873, p. 815.
Do	1873		1874, p. 81.
Do	1889		1890, p. 965.
Do	1899	House 105, 56th Cong., 1st sess	1900, p. 1605.
History			1894, p. 124.

Amount appropriated by river and harbor act approved June 13, 1902 .. $16,665.00
July 1, 1902, balance unexpended 16,665.00

(See Appendix J 1.)

2. Susquehanna River above and below Havre de Grace, Md.—The original governing depth was 5 feet at mean low water. The mean range of the tide is 2 feet. The channel above Havre de Grace was narrow and one cause of ice gorges. The original project is dated February 22, 1853, and was for a channel 12 feet deep and 100 feet wide, at an estimated cost of $59,000. Improvements have been in progress since 1853, and up to August 22, 1882, when the existing project was

adopted, $97,390 had been expended upon them. The existing project is to give a channel 15 feet deep at mean low water below Havre de Grace and to remove the shoal opposite Watson Island (which is above Havre de Grace) to a depth of 8 feet at the same stage of the tide, at an estimated cost of $168,000. The amount expended on that project is $63,765.95, and resulted in dredging a channel below Havre de Grace to a depth of 12 feet and in partially removing the shoal near Watson Island. No work has been done since 1889 and the channels have shoaled again, but to what extent can not be determined until an examination is made. Ten thousand dollars was appropriated by the river and harbor law approved June 13, 1902, for work above and below Havre de Grace, and $9,734.05 is also available of former appropriations, but this latter sum is restricted in expenditure to the part of the river above the bridge; $19,734.05 is therefore available for operations under the existing project, and the expenditure of this sum will be undertaken in carrying forward work under it. Efforts have been made, without avail, to secure complete commercial statistics of the river.

References.

Subject.	When made.	Document.	Annual report.
Survey	1890-91	House Ex. 52, 52d Cong., 1st sess	1892, p. 994.
History			1900, p. 218.

July 1, 1901, balance unexpended	$9,734.05
Amount appropriated by river and harbor act approved June 13, 1902	10,000.00
July 1, 1902, balance unexpended	19,734.05

(See Appendix J 2.)

3. Patapsco River and channel to Baltimore, Md.—The controlling depth was 17 feet when in October, 1853, improvements were commenced. The original project was dated April 15, 1853, and was for a channel 22 feet deep at mean low water and 150 feet wide, at an estimated cost of $390,000. Pages 231 and 232 of the Annual Report for 1900 describe the successive stages in which operations were carried on whereby the facilities for navigation from the Chesapeake Bay to Baltimore were improved by dredging, under the various projects, until, in 1892, there was a ship channel 27 feet deep at mean low water, 600 feet wide at bottom in the straight reaches and over 1,200 feet in the angles. The cost of those operations amounted to $3,316,030. The existing project has cost to date $1,153,106.76. It was approved July 10, 1896, and is to increase the depth of the channel to 30 feet, retaining the bottom width and making the side slopes 3 feet base to 1 foot vertical. It was estimated to cost $2,500,000, and $50,000 per annum for maintenance, but the project will be completed with an expenditure considerably less than the estimate, owing to the fact that the material was dumped in the bay, whereas it was at first thought it might be necessary to put it ashore. The channel is in subdivisions, being named, respectively, the Fort McHenry, the Brewerton, the Cut-off, and the Craighill divisions.

During the past fiscal year work on the existing project has resulted in increasing the width (for a 30-foot depth) of the Fort McHenry Channel from 565 feet to 600 feet; the Brewerton from 460 feet to 590 feet;

the Cut-off from 450 feet to 525 feet, and the Craighill from 565 feet to 600 feet. Most of the angles have also been given the 30-foot depth for their original width of over 1,200 feet.

The continuing contract now in execution will complete the existing project, but the channel is not adequate for the commerce of the port and, the depth at least, should be increased to accommodate the full draft of the vessels using the port. The mean range of tide is little over 1 foot. With this necessity in view Congress, by concurrent resolution, called for an estimate of the cost of increasing the depth of the channel to 35 feet and the width to 1,000 feet. That estimate is printed in Senate Doc. No. 118, Fifty-sixth Congress, second session. It was explained in response to the concurrent resolution that the estimate was a hurried one and could not be made with accuracy with the data available.

The draft that can now be carried to Baltimore over the shoalest part of the channel is 30 feet at mean low water. There are a few shoals of a trifle less depth, but these will soon be removed.

The tonnage movement of the port has been as follows:

Fiscal year ending June 30—	Tons.	Fiscal year ending June 30—	Tons.
1889	3,243,017	1896	5,363,894
1890	4,237,361	1897	6,868,120
1891	4,495,469	1898	7,339,405
1892	5,224,042	1899	6,843,620
1893	4,607,176	1900	7,941,580
1894	4,752,946	1901	8,055,017
1895	4,794,964	1902	7,529,870

The statistics of the port for the past fiscal year are illustrated briefly by the following table:

Dutiable imports have increased	$1,972,977.00
Free imports have increased	$2,074,179.00
Domestic exports have decreased	$25,658,317.00
Tonnage (foreign) has decreased tons..	647,300
Duties collected have increased	$485,723.56
Duties on merchandise in bond have decreased	$7,959.97
Duties on merchandise in bond, with and without appraisement, have decreased	$69,072.87

References.

Subject.	When made.	Document.	Annual report.
History			1874, p. 18.
Do			1900, p. 231.
Survey	1894	House Ex. 57, 53d Cong., 3d sess	1895, p. 1201.
Do	1896	House 50, 54th Cong., 2d sess	1897, p. 1308.
Do	1901	Senate 118, 56th Cong., 2d sess	1901, p. 1395.

July 1, 1901, balance unexpended	$566,268.76
Amount appropriated by river and harbor act approved June 13, 1902	25,000.00
	591,268.76
June 30, 1902, amount expended during fiscal year	319,375.52
July 1, 1902, balance unexpended	271,893.24
July 1, 1902, outstanding liabilities	3,100.00
July 1, 1902, balance available	268,793.24
July 1, 1902, amount covered by uncompleted contracts	155,365.11

(See Appendix J 3.)

4. Channel to Curtis Bay, in Patapsco River, Baltimore Harbor, Maryland.—There was a controlling depth of 20 feet at mean low water in 1893, when the first project for improvement was undertaken. The mean range of the tide is a little over 1 foot. The original project was dated July 15, 1892, and was for a channel 27 feet deep at mean low water and a bottom width of 150 feet, at an estimated cost of $85,000. Forty thousand dollars of the estimate was appropriated, and with this total expenditure the channel was first made 25 feet deep for the project width and then dredged to 27 feet depth for a width of 70 feet in the axis of the 150-foot channel. That project never was completed. It was superseded by a project in the river and harbor law approved June 13, 1902, for deepening the channel to 30 feet and widening it to 250 feet, and authority granted to make continuing contracts to complete the work. The estimated cost is $196,000.

This bay is in the collection district of Baltimore, and the statistics are attached to the report for that harbor.

References.

Subject.	When made.	Document.	Annual report.
Survey	1890	House Ex. 102, 51st Cong., 2d sess.	1891, p. 1243.
Do	1901	Senate 118, 56th Cong., 2d sess.	1901, p. 1394.
History			1901, p. 265.

Amount appropriated by river and harbor act approved June 13, 1902	$50,000.00
July 1, 1902, balance unexpended	50,000.00
Amount (estimated) required for completion of existing project	146,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	146,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix J 4.)

5. Harbor of southwest Baltimore (Spring Garden), Md.—No work has been done by the United States, but the city of Baltimore dredged a channel from the main ship channel to the foot of Eutaw street, which has a controlling depth of 15 feet at mean low water. The average rise of the tide is about 15 inches. In response to a resolution of the House of Representatives an estimate was furnished March 7, 1896, of the cost of deepening the channel to a depth of 27 feet. It is for a channel 100 feet wide on the bottom, with side slopes of 1 on 3, from the main ship channel near Fort McHenry to the foot of Eutaw street, with a turning basin 400 feet by 400 feet near the upper end, at an estimated cost of $314,000. Five thousand dollars was appropriated June 23, 1896, but it was deemed inexpedient to start the work with that small sum. June 13, 1902, $88,000 was appropriated and authority granted to enter into contracts for the completion of the work.

The commercial statistics of the port of Baltimore include this harbor.

Reference.

Subject.	When made.	Document.	Annual report.
Survey	1896	House 304, 54th Cong., 1st sess.	1896, p. 1006.

July 1, 1901, balance unexpended	$5,000.00
Amount appropriated by river and harbor act approved June 13, 1902	88,000.00
July 1, 1902, balance unexpended	93,000.00
Amount (estimated) required for completion of existing project	221,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	221,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix J 5.)

6. Harbors at Rockhall, Queenstown, Claiborne, and Cambridge; and Chester, Choptank, Warwick, Pocomoke, and Wicomico rivers, and Tyaskin Creek, Maryland.—(*a*) *Rockhall Harbor and inner harbor at Rockhall.*—In 1894 the controlling depth was 5 feet, with an average range of tide of 1.1 feet. With $16,600, appropriated June 3, 1896, a project was carried out in 1897–98 by dredging a cut 80 feet wide and 10 feet deep at mean low water from the 10-foot curve in Swan Creek Inlet to the 10-foot depth in Chesapeake Bay, and a channel 100 feet wide and 10 feet deep from that depth in Swan Creek Inlet to the old pier at Rockhall. A turning basin, embracing the old and new piers, was also dredged. The date of this original project was September 23, 1896, and the estimated cost $16,600. The amount expended to June 30, 1902, is $16,597.12, and $2.88 was returned to the Treasury.

A report on a survey made in 1899 contains a project for dredging a channel 150 feet wide and 12 feet deep at mean low water, at an estimated cost of $43,065. Seventy-four thousand dollars was appropriated in the river and harbor law approved June 13, 1902, for this and other harbors and rivers on the easterly shore of the Chesapeake Bay. There has been considerable shoaling, but the draft that can be carried June 30, 1902, at mean low water over the shoalest part can not be determined until an examination is made. About 50 vessels of from 5 to 50 tons make this harbor their headquarters, and 2 steamers make a daily service from Baltimore. Full statistics of commerce are included in the report of the engineer officer in charge (see Appendix J, herewith).

The harbor is in the collection district of Baltimore.

References.

Subject.	When made.	Document.	Annual report.
Survey	1891	House Ex. 56, 52d Cong., 1st sess	1892, p. 999.
Do	1894	House Ex. 200, 53d Cong., 3d sess	1895, p. 1162.
Do	1899	House 99, 56th Cong., 1st sess	1900, p. 1670.
History			1900, p. 218.

(*b*) *Queenstown Harbor.*—The original project was submitted in March, 1871, and was for a channel 100 feet wide at bottom and 8 feet deep at mean low water, at an estimated cost of $9,500. Before 1871 the controlling depth was 6 feet, with a mean range of tide of 18 inches, but since that time (with an expenditure of $18,610.57 in dredging to June 30, 1900) a project, adopted September 30, 1896 (which is similar to former ones), for a channel 8 feet deep at mean low water and 100 feet wide from the 8-foot curve in the Chester River to the inner harbor, has has been completed.

A report on a survey made in 1899 recommends the dredging of a channel 200 feet wide and 10 feet deep at mean low water, at an estimated cost of $23,100. In the river and harbor law approved June 13, 1902, Congress appropriated $74,000 for this and other harbors and rivers on the easterly shore of the Chesapeake Bay. The amount expended to June 30, 1902, is $19,000. The maximum draft that could be carried over the shoalest part of the channel June 30, 1902, was 8 feet at mean low water.

The tonnage of the harbor is reported to be as follows:

1898	25,845
1900	12,373
1901	11,328

References.

Subject.	When made.	Document.	Annual report.
Survey	1870	House Ex. 60, 41st Cong., 3d sess	1871, p. 613.
Do	1899	House 92, 56th Cong., 1st sess	1900, p. 1673.
History			1900, p. 219.

(*c*) *Claiborne Harbor.*—Claiborne is on the eastern shore of Eastern Bay, an estuary of Chesapeake Bay, about 6 miles east from Bloody Point light-house. No improvement there has ever been made by the United States. The controlling depth is 9 feet at mean low water, with a mean range of tide of 2 feet. A report on a survey made in 1899 proposes to dredge a channel 12 feet deep at mean low water and 300 feet wide from the 12-foot contour in Eastern Bay to the railroad pier in the harbor, a distance of about 1,900 feet, and thence shoreward along the south side of the pier to a width of 195 feet for a length of 500 feet. The estimated cost of the channel is $17,490. An estimate of $2,500 is also submitted for an extension of the existing jetty, but such extension is not advised unless it should hereafter be found necessary. The river and harbor law of June 13, 1902, makes an appropriation of $74,000 for this and other harbors and rivers on the easterly shore of the Chesapeake Bay.

Reference.

Subject.	When made.	Document.	Annual report.
Survey	1899	House 81, 56th Cong., 1st sess	1900, p. 1677.

(*d*) *Cambridge Harbor.*—This harbor is on the eastern side of the Choptank River, about 20 miles above its mouth. In 1870, before operations were commenced, there was a controlling depth of 4 feet, with an average rise and fall of tide of 1.9 feet. The improvement of the harbor was commenced in 1871 with a project submitted in March of that year for an entrance way of 100 feet in width and to provide sufficient harbor accommodations of a depth of 10 feet at mean low water. The estimated cost was $36,000. Ten thousand dollars was appropriated March 3, 1871, and work begun. On this and succeeding projects $50,237 was expended to June 30, 1896, resulting in a channel 150 feet wide and 12 feet deep at mean low water from that depth in the

Choptank River to the railroad wharf, a distance of nearly a mile. The inner harbor below the bridge had been dredged over its whole irregular area to a depth of 10 feet, and the part of the harbor above the bridge for a distance of 750 feet had been dredged to a depth of 8 feet and a width of 215 feet. Nothing has been done since. A third survey was made in 1896, and the improvements then recommended were for a 12-foot low-water channel 150 feet wide from the 12-foot curve in the Choptank River to a point 500 feet outside the Baltimore, Chesapeake and Atlantic Railroad Company's steamboat wharf, and from this point gradually widening to the harbor line at the wharf; from the steamboat wharf to Mill wharf, to increase the width an average of 200 feet with a depth of 8 feet, making an anchorage basin; increasing the width of the lower harbor 40 feet on the north side and widening the upper harbor an average of 360 feet along the channel already dredged to a depth of 8 feet. The estimated cost of the project is $8,120. In the river and harbor law approved June 13, 1902, Congress appropriated $74,000 for this and other harbors and rivers on the easterly shore of the Chesapeake Bay.

References.

Subject.	When made.	Document.	Annual report
Survey	1870	House Ex. 60, 41st Cong., 3d sess	1871, p. 615.
Do	1887		1887, p. 851.
Do	1896	House 119, 54th Cong., 2d sess	1897, p. 1296.
History			1896, p. 133.

(*e*) *Chester River, Maryland, from Crumpton to Jones Landing.*—Before operations were undertaken vessels at low tide drawing 6 feet of water could reach Crumpton, 33 miles above the mouth, and from that point to Jones Landing, 6¼ miles, the controlling depth was 3 feet with a mean range of tide of 1.2 feet. The project for improvement, adopted October 21, 1890, is for a 6-foot low-water channel from Crumpton to Jones Landing, at an estimated cost of $12,750; increased in 1896 to $14,250, and still later to $19,562.50. There has been but one project for this river. By June 30, 1900, the projected channel had been brought to within less than a half mile of Jones Landing by dredging. No work has been done on the river since. The amount expended to June 30, 1902, is $13,979.26. The dredged portion of the channel has generally been well maintained, but at one place has shoaled to a depth of 3.8 feet. Owing to the fact that a part of the channel has not been improved, a draft of only 2 feet can be carried through on June 30, 1902. The river and harbor law of June 13, 1902, appropriates $74,000 for this and other rivers and harbors on the easterly shore of the Chesapeake Bay.

The tonnage of the river for 1901 was reported to be 41,733.

References.

Subject.	When made.	Document.	Annual report.
Survey	1889	House Ex. 65, 51st Cong., 1st sess	1890, p. 956.
History			1900, p. 219.

(*f*) *Choptank River.*—The controlling depth before improvements were begun in 1880 was 2 feet at mean low water, with a mean range of tide of 2 feet. The original project, which is the existing one, was adopted June 14, 1880, and is for a channel 75 feet wide and 8 feet deep at mean low water from the 8-foot depth near Denton to the bridge at Greensboro, 8 miles above, at an estimated cost of $79,000. The expenditures to June 30, 1902, amounted to $59,901.52 and completed the project with the exception of a 1,600-foot length of channel where but 7 feet was dredged. There has been some shoaling and the maximum draft that can now be carried over the shoalest part of the channel is 6 feet. No work was done in the fiscal year ending June 30, 1902. The river and harbor law of June 13, 1902, appropriates $74,000 for this and other rivers and harbors on the easterly shore of the Chesapeake Bay.

The tonnage of the river is reported to be as follows:

1890	6,904
1899	21,399
1900	157,094

Five steamers are engaged in a daily service to Baltimore, and a large number of sailing vessels also trade on the river.

References.

Subject.	When made.	Congressional document.	Annual report.
Survey	1879		1880, p. 634.
History			1900, p. 220.

(*g*) *Warwick River.*—This stream, formerly known as Secretary Creek, is an estuary 2 miles long of the Choptank River, and had a controlling depth of 4 feet, with an average rise and fall of 1.7 feet in the tide. Prior to 1892 private parties and the General Government had each expended $6,000 in improving it to a depth of 9 feet for a narrow channel, but August 4, 1892, the existing project was adopted, which is for a channel 100 feet wide and 10 feet deep at mean low water from the 10-foot depth in Choptank River to Secretary Landing, at the head of the river, including a turning basin at the latter point, at an estimated cost of $18,600. To June 30, 1902, there had been expended $12,000 on this project, and this resulted in completing the turning basin and the channel except for a length of 450 feet at Devils Wind Gap. There was no dredging done in the fiscal year ending June 30, 1902, but the maximum draft that can be carried through is 8.5 feet. Seventy-four thousand dollars was appropriated by the river and harbor law of June 13, 1902, for this and other rivers and harbors on the easterly shore of the Chesapeake Bay. Two steamers with a daily service and 100 sailing vessels are reported as trading on the river.

References.

Subject.	When made.	Congressional document.	Annual report.
Examination	1889		1889, p. 919.
Survey	1891		1891, p. 1218.
History			1900, p. 222.

(*h*) *Pocomoke River.*—The controlling depth before improvements were begun was on the mud flats at the mouth of the river, being 4½ feet at mean low water, with an average rise of tide of 2.21 feet. A survey was made in 1878. The improvement of the river was commenced in 1879 under a project dated November 19, 1878, for the expenditure of an appropriation of $10,000, made June 18, 1878, which is given in much detail on pages 505 and 506 of the annual report for 1879. The estimated cost was $7,851.25. From 1879 to 1888 a channel 7 feet deep at mean low water and not less than 80 feet wide had been dredged between Snowhill and Shad Landing, a distance of about 4⅛ miles, at a cost of $20,500. A survey was again made in 1894–95. The existing project, adopted October 1, 1896, is for a channel between Snowhill and Shad Landing, 9 feet deep at mean low water and from 100 to 130 feet wide, at an estimated cost of $14,000. Up to the close of the fiscal year ending June 30, 1902, there had been $8,000 expended upon it, resulting in a channel 9 feet deep with widths varying from 80 to 130 feet. From the lower cut-off to Snowhill, a distance of about 1 mile, the channel requires widening to complete the project. On September 21, 1900, the maximum draft that could be carried over the shoalest part of the river under improvement was 9 feet at mean low water, but shoaling has since occurred, so that on June 30, 1902, the maximum draft was only 7.5 feet. The sum of $74,000 was appropriated in the act of June 13, 1902, for this and other rivers and harbors on the easterly shore of the Chesapeake Bay.

The following is the reported tonnage for the river:

1898	45,742
1899	50,866
1900	183,429

One semiweekly steamer and sailing vessels of an aggregate tonnage of 6,610 are reported as trading on the river.

References.

Subject.	When made.	Congressional document.	Annual report.
Survey	1878		1879, p. 507.
Do	1894-95		1895, p. 1167.
Original project			1879, p. 505.
History			1900, p. 228.

(*i*) *Wicomico River.*—In 1871 before operations were commenced there was a controlling depth of 8 feet at mean low water to within 2 miles of Salisbury, and 1 foot at Salisbury, with an average rise and fall of tide of 3 feet. The original project was dated June 21, 1872, and was for a channel 7 feet deep and 75 feet in width, at an estimated cost of $17,000. In 1885 there had been dredged a channel to Salisbury with a depth of 7 feet at mean low water and a least width of 75 feet, which had cost the United States $50,000. The existing project was adopted December 29, 1890, and provides for a channel 9 feet deep at mean low water with a width of from 100 to 150 feet, from the like depth near Fruitland wharf to the drawbridge at Salisbury, at an estimated cost of $23,200, subsequently increased to $29,998. Up to June 30, 1902, there has been $23,198 expended on the existing project and

the dredging involved in the project is completed, but shoaling has taken place to the extent of about 41,200 cubic yards of material. The maximum draft at mean low water that could be carried through, June 30, 1902, is reported to be 8 feet. The sum of $74,000 is appropriated for this and other rivers and harbors on the easterly shore of the Chesapeake Bay in the river and harbor law of June 13, 1902.

The tonnage of the river is reported to be as follows:

1891	36,252
1899	252,292

References.

Subject.	When made.	Document.	Annual report.
Survey	1871		1871, p. 621.
Do	1888–89	House Ex. 20, 51st Cong., 1st sess.	1890, p. 947.
History			1900, p. 226.

(*j*) *Tyaskin Creek.*—This stream is also known as Wetipquin River. It is a small tributary of the Nanticoke River, having a length of about 5 miles. No work has ever been done on this creek. The controlling depth in the creek is 8 feet, but on the bar at the mouth it is reported to be but 3½ feet at mean low water, with an average rise and fall of the tide of 3 feet. The present commerce is not large, but the prospective commerce is reported as justifying an improvement of the stream. An examination of the stream was made in 1888, and an examination and survey was also made in 1899. The latter report proposes a channel 9 feet deep at mean low water with a width of 120 feet, at an estimated cost of $13,200. The river and harbor law of June 13, 1902, appropriated $74,000 for this creek and certain rivers and harbors on the easterly shore of the Chesapeake Bay.

References.

Subject.	When made.	Document.	Annual report.
Examination	1888		1889, p. 910.
Survey	1899	House 109, 56th Cong., 1st sess.	1900, p. 1682.

July 1, 1901, balance unexpended	$924.37
Amount appropriated by river and harbor act approved June 13, 1902	74,000.00
	74,924.37
June 30, 1902, amount expended during fiscal year	603.15
July 1, 1902, balance unexpended	74,321.22

(See Appendixes J 6–15.)

7. *La Trappe River, Md.*—This stream, formerly known as Dividing Creek, has a length of about 3 miles and is a tributary of the Choptank River. The controlling depth prior to 1893 was 4 feet with a mean range of tide of 18 inches, but was afterwards increased to 8 feet by dredging under private subscription. The original project is the existing one adopted August 5, 1892, and is for a channel 150 feet wide and 11 feet deep at mean low water across the bar at the mouth, and for a width of 75 feet and a depth of 8 feet inside the bar as far as Trappe Landing, with a turning basin at the latter point, at an

estimated cost of $7,250, subsequently increased to $9,750. The amount expended to June 30, 1902, is $7,213.87, and has resulted in completing the project except for a length of 1,200 feet over the bar, where the width is but 100 feet. There has been no dredging done since 1895, and the maximum draft that can be carried over the shoalest part of the channel on June 30, 1902, is unknown.

The tonnage of the river is reported to be as follows:

1893	29,094
1899	12,593
1900	8,089

Three steamers and 14 schooners are reported as regularly trading on the river.

References.

Subject.	When made.	Document.	Annual report.
Survey	1891	House 114, 54th Cong., 2d sess	1891, p. 1215.
History			1900, p. 222.

July 1, 1901, balance unexpended	$36.13
July 1, 1902, balance unexpended	36.13

See (Appendix J 16.)

8. Nanticoke River, Delaware and Maryland.—This work is completed and no appropriation has been made for further improvement. The original controlling depth was 8 feet. Before the adoption of the existing project a channel 9 feet deep at mean low water and 100 feet wide had been dredged from the railroad bridge at Seaford to a point 8,000 feet below at a cost of $5,000. The existing project, adopted September 22, 1896, is for a channel 9 feet deep at mean low water and 100 feet wide, the width to be increased to about 150 feet at sharp turns, the improvement to be extended to within 100 feet of the county bridge, where it is to widen out fan shape, at an estimated cost of $13,000. The amount expended on the existing project to the close of the fiscal year ending June 30, 1902, was $5,213.50 (which included an appropriation of $5,000 in the act of August 18, 1894, for Broad Creek River, Delaware), and resulted in completing the project. No work has been done since July 25, 1900. The maximum draft that can be carried June 30, 1902, at mean low water over the shoalest part of the improvement is reported to be 9 feet. The average rise and fall of the tide is 3.4 feet.

The tonnage of the river is reported to be as follows:

1898	18,121
1899	17,221
1900	87,467

Fifty-five sailing vessels are reported to be engaged in trading on the river.

References.

Subject.	When made.	Document.	Annual report.
Examination	1892	House Ex. 120, 52d Cong., 2d sess	1893, p. 1236.
Survey	1894-95	House Ex. 323, 53d Cong., 3d sess	1895, p. 1165.
History			1900, p. 224.

July 1 1901, balance unexpended	$852.86
June 30, 1902, amount expended during fiscal year	66.36
July 1, 1902, balance unexpended	786.50

(See Appendix J 17.)

9. Broad Creek River, Delaware.—This is a tributary of the Nanticoke River, and in 1881 the controlling depth was 1½ feet, with a mean range of tide of 3 feet. In 1889 a channel 6 feet deep at mean low water and 50 feet wide had been dredged from Bethel to Laurel at a cost of $35,000. The existing project, adopted August 5, 1892, is for a channel 70 feet wide and 8 feet deep at mean low water, between Bethel and Laurel, at an estimated cost of $15,000. The projected channel has been dredged except for a short distance at the upper end, where it is reduced to 60 feet in width to secure the stability of some wharves. The amount expended to June 30, 1902, on the existing project is $14,625.20. The improvement is practically completed and no appropriation has been made since 1899. The maximum draft that can be carried June 30, 1902, at mean low water over the shoalest part of the channel is reported to be 8 feet.

References.

Subject.	When made.	Congressional document.	Annual report.
Survey	1879		1880, p. 640.
History			1900, p. 225.

July 1, 1991, balance unexpended	$385.75
June 30, 1902, amount expended during fiscal year	10.95
July 1, 1902, balance unexpended	374.80

(See Appendix J 18.)

10. Manokin River, Maryland.—The controlling depth of this stream before 1891 was on the mud flats at the mouth, and was less than 2 feet, with an average rise of tide of 2.6 feet. The existing project, which is the original one, was adopted November 24, 1890, and is for a channel 6 feet deep at mean low water and 100 feet wide from Locust Point to Sharps Point, across the mud flats, a distance of 2½ miles, at an estimated cost of $30,000. The amount expended to June 30, 1902, is $22,384.97, and $2,000 additional was expended on the upper river, which is not included in the existing project. With those funds a channel was dredged to the project depth, but with a width varying, and in no place greater than 80 feet. Soundings were taken between August 2 and 15, 1900, which showed a range of depths from 4.5 to 7.3 feet over areas that had formerly been dredged. The maximum draft that could be carried through June 30, 1902, was 4 feet at mean low water. No appropriations have been made for this river since 1899, and no work has been done since 1900.

References.

Subject.	When made.	Document.	Annual report.
Survey	1889	House Ex. 149, 51st Cong., 1st sess	1890, p. 959.
History			1900, p. 227.

July 1, 1901, balance unexpended	$237.95
June 30, 1902, amount expended during fiscal year	122.92
July 1, 1902, balance unexpended	115.03

(See Appendix J 19.)

11. Removing sunken vessels or craft obstructing or endangering navigation.—The schooner *Eldridge*, sloop *Ephraim Lyttee*, sloop *Maggie*, and hull of an old pile driver were wrecked and sunk in Cambridge Harbor, Maryland, in 1897 and 1898, were abandoned, and were obstructions to navigation. They were all south of the drawbridge, in from 4½ to 7 feet of water. The wrecks were removed, at a cost of $633, and unobstructed navigation restored in August, 1901.

The barge *Milgendutt* was sunk in the upper end of the Chesapeake Bay July 7, 1901, was abandoned, and was an obstruction to navigation. The wreck was removed August 12, 1901, by the owners without cost to the United States.

The schooner *Ida E. Comley*, with a cargo of bituminous coal, sunk in the Chesapeake Bay off Sandy Point light-house in September, 1901. The wreck was removed October 5, 1901, at a cost of $500, and unobstructed navigation restored.

The total amount expended during the past fiscal year on removal of wrecks was $1,133.

(See Appendix J 20.)

IMPROVEMENT OF POTOMAC RIVER AND ITS TRIBUTARIES, OF JAMES RIVER, AND OF HARBOR AT MILFORD HAVEN, VIRGINIA, AND OF CERTAIN RIVERS IN MARYLAND AND VIRGINIA ON THE WESTERN SHORE OF CHESAPEAKE BAY; PROTECTION OF JAMESTOWN ISLAND, VIRGINIA.

This district was in the charge of Lieut. Col. Chas. J. Allen, Corps of Engineers.

1. Potomac River at Washington, D. C.—The existing, which is also the original, project for this improvement was adopted by act of Congress of August 2, 1882, and contains the following provision as to channel depth:

> It is regarded as necessary to the proper execution of this plan, as thus defined, that the channel depths in both Washington and Georgetown harbors should be sufficient to accommodate the largest draft vessels that can be brought up to Arsenal Point, with such additional depth at the wharves that vessels can receive their full cargoes without grounding at low water.

The projected depth was not stated in feet, but by the above imposed condition was at that time limited to 20 feet at low tide, and this depth was adopted in all estimates for the work.

By act of March 3, 1899, Congress, however, authorized the dredging of channels 24 feet deep at low tide through all shoals in the Potomac River below Washington, D. C. This work is now in progress under a continuing contract, and it is anticipated that it will be completed during the ensuing fiscal year.

Upon the completion of this dredging of the shoals in the Potomac River below Washington, the adopted project for improving the Potomac River at Washington, D. C., will, without any alteration, provide for a similar increase in channel depth at Washington, for which, however, the present estimates make no provision.

The desirability of extending the advantages of increased depth in the Lower Potomac River at an early date, so that deep-draft vessels may reach the navy-yard and wharves at Washington, is obvious and need not be dwelt upon here.

The present project has for its object the improvement of the navi-

gation of the river by widening and deepening its channels, reclamation of the flats by depositing on them the material dredged from the channels, the freeing of the Washington Channel, so far as it can be done, of sewage, and the establishment of harbor lines beyond which no wharves shall be built. To effect these the project provides for 20 feet depth in the channels at low water, for filling in the flats to a height of 3 feet above the flood plane of 1877, and for a tidal reservoir or basin above Long Bridge, to be provided with inlet and outlet gates of ample dimensions, to work automatically, and so arranged as to admit of the basin being filled from the Virginia Channel on the flood tide and discharged into the Washington Channel on the ebb. An ample system of drainage for the reclaimed area was also contemplated.

A training dike on the Virginia shore, extending downstream from the foot of Analostan Island, was added to the project in 1890.

The project also provides for the interception of all sewage now discharged into the Washington Channel and its conveyance to the James Creek sewer canal, but this work was not included in the estimated cost of the improvement, which, as revised in 1897, is $2,953,020.

The amount expended to the close of the fiscal year ending June 30, 1902, was $2,346,411.76.

The expenditure resulted in the dredging of a channel 20 feet deep and 550 feet wide through the bar above Long Bridge, and in restoring the standard 20-foot navigation by redredging shoals due to freshets; in increasing the width of the natural channel just below Long Bridge by 50 to 500 feet and in deepening it to 20 feet; in dredging a channel 350 feet wide and 20 feet deep through the bar in the Virginia Channel near Giesboro Point; in dredging the Washington Channel to a width of 400 feet and a depth of 20 feet for a navigation channel, and in dredging between this navigation channel and the wall of the adjacent reclaimed area to a depth of 12 feet; in dredging at the junction of the Washington and Virginia channels; in dredging the tidal reservoir (111 acres) to a depth of about 8 feet; in the construction of the reservoir outlet, and in the construction of 35,289 linear feet of sea wall, of which 4,190 linear feet has been taken down and relaid, and 5,965 linear feet of training dike.

The total amount of material dredged from the channels, from the commencement of the improvement (1882) to date and deposited on the flats, is about 11,565,427 cubic yards.

The area of land reclaimed by these operations is 621.12 acres (or, including reservoirs, 739.42 acres), which, by act of March 3, 1897, was declared to be a public park, under the name of Potomac Park.

The maximum draft that could be carried through the Washington Channel on June 30, 1902, at mean low tide, was 20 feet; for the Virginia Channel it was 19.5 feet.

The benefits to navigation from the improvements have been marked. Vessels can come to Washington loaded more heavily than was formerly the case. The value of the commerce to be benefited may be judged of by examination of the following table, showing the commerce of the port of Washington, in tons, from 1887 to 1901, inclusive:

	Tons.		Tons.
1887	618,972	1895	693,450
1888	581,575	1896	723,657
1889	488,680	1897	593,684
1890	519,696	1898	645,239
1891	551,219	1899	715,549
1892	766,954	1900	661,420
1893	653,433	1901	706,551
1894	644,588		

The items of work remaining to be completed are the dredging to full width of the Virginia Channel, the maintenance of both the channels (Washington and Virginia), the raising of the incompletely raised portions of the area to the full height contemplated by the project, the completion of the sea wall of the tidal reservoir, the construction of the reservoir inlet gates, and completion of the training dike on the right of the Virginia Channel above Long Bridge.

For more detailed account of this work reference is made to the last annual report.

July 1, 1901, balance unexpended	$92,988.17
Amount appropriated by river and harbor act approved June 13, 1902	75,000.00
	167,988.17
June 30, 1902, amount expended during fiscal year	80,399.93
July 1, 1902, balance unexpended	87,588.24
July 1, 1902, outstanding liabilities	648.00
July 1, 1902, balance available	86,940.24

(See Appendix K 1.)

2. Potomac River below Washington, D. C.—The Potomac River below Washington D. C., is generally a wide and deep body of water, having the characteristics of a tidal estuary rather than of a fluvial stream.

In 1891 a survey of the obstructions to 24-foot navigation was made and a report rendered which is printed as House Ex. Doc. No. 33, Fifty-second Congress, first session, and in the Annual Report of the Chief of Engineers for 1892, page 1069.

The present, which is also the original, project for this improvement was adopted by act of Congress of March 3, 1899, which act further provided for prosecuting the work under a continuing contract. This project contemplates the improvement of the waterway by dredging channels 24 feet deep and 200 feet wide through all obstructions to 24-foot navigation below Washington, D. C., at an estimated cost of $158,400.

The amount expended to June 30, 1902, was $85,206.27, none of which was applied to maintenance. The work done has resulted in dredging channels 200 feet wide and 24 feet deep entirely through Smiths Point upper shoal, Smiths Point lower shoal, and Maryland Point Shoal, and through Mattawoman Shoal, except for a length of about 2,500 feet, where two ridges of hard material were encountered. The overlying soft material has been removed from both of these ridges and a channel 80 feet wide and 24 feet deep has been cut through the upper ridge.

The maximum draft that could be carried over the shoals in the Potomac River below Washington, D. C., on June 30, 1902, at low tide was about 21.2 feet and the mean range of tides is about 1.6 feet.

The total tonnage annually passing through these channels is estimated at from 900,000 to 1,000,000 tons. In connection with this reference is made to the commercial statistics in the report upon improvement of the Potomac at Washington, D. C.

For the completion of the work provided for under the present project the appropriation of March 3, 1901, appears sufficient. A channel only 200 feet wide is, however, regarded as rather contracted for a river of the width and importance of the Potomac, and especially in view of the location of the Washington navy-yard upon its shores.

During the ensuing year so much of the unexpended balance as is required will be applied in completing the channels provided for by the existing project by dredging and rock excavation.

It is hoped that an increase in width of these channels to 400 feet may soon be authorized by Congress.

July 1, 1901, balance unexpended	$126,687.55
June 30, 1902, amount expended during fiscal year	35,893.82
July 1, 1902, balance unexpended	90,793.73
July 1, 1902, outstanding liabilities	278.00
July 1, 1902, balance available	90,515.73
July 1, 1902, amount covered by uncompleted contracts	39,945.00

(See Appendix K 2.)

3. Anacostia River, D. C.—Congress by act approved June 13, 1902, appropriated the sum of $150,000 for improving Anacostia River, with a view to the interests of commerce and navigation, in accordance with such portions of the report submitted in House Doc. No. 87, Fifty-fifth Congress, third session (reprinted at p. 1443 of Annual Report of the Chief of Engineers for 1899), as relates to section 1 of said river, being the portion below the navy-yard bridge.

The part of the project considered in the report referred to (House Doc. No. 87, Fifty-fifth Congress, third session) relating to the main channel for commerce and navigation, provided for a channel 20 feet deep at mean low tide and 400 feet wide from the mouth of the river to the navy-yard, including sufficient turning room in front of the yard.

The last work done upon the Anacostia by the Engineer Department for improvement of the navigation of the stream was under an allotment of $20,000 included in the item in the act of September 19, 1890, for improving the Potomac River at Washington. Under this allotment, channels 20 feet deep and about 200 feet wide were dredged through shoals near the foot of South Capitol street and off Greenleaf or Arsenal Point. This dredging was completed in May, 1892, at a cost of $18,536.94.

It is proposed to begin the work provided for in the act of June 13, 1902, at an early day.

July 1, 1901, balance unexpended (improving Potomac River, "Eastern Branch," act September 19, 1890)	$1,463.06
Amount appropriated by river and harbor act approved June 13, 1902	150,000.00
July 1, 1902, balance unexpended	151,463.06

(See Appendix K 3.)

4. Breton Bay and Patuxent River, Maryland.—Improvement of these streams was included in a lump sum of $9,000 appropriated by act of Congress of June 13, 1902, the specific amounts to be allotted by the War Department. As recommendations for these allotments have to await the results of examinations shortly to be undertaken, no more definite report can here be made.

Amount appropriated by river and harbor act approved June 13, 1902	$9,000.00
July 1, 1902, balance unexpended	9,000.00

(See Appendix K 4.)

5. York River, Occoquan, Lower Machodoc, Naudua, Aquia, and Carters creeks, Virginia.—(*a*) *York River.*—York River is 41 miles long and discharges into Chesapeake Bay about 16 miles above Old Point Comfort. Entering the river, 24 feet can be carried for 32 miles, or up to Potopotank bar, 9 miles below Westpoint. In 1880 the ruling depth on this bar was 18.5 feet. Westpoint bar, the next obstruction to navigation, commences about 2 miles below and extends up to Westpoint. Before improvement it had a ruling depth of 15.5 feet.

The original project for improvement, adopted in 1880, proposed dredging channels 22 feet deep and 200 feet wide through the bars. In 1884, on account of growth of trade, the width was increased to 400 feet, and in 1887 the project was further amended to include construction of a dike along the right bank at Westpoint bar to maintain the channel. Total cost of the revised, which is the present, project, $308,800.

The amount expended to June 30, 1902, was $239,129.02. It resulted in a dredged channel 105 feet wide and 22 feet deep at Potopotank, and one 22 feet deep and 160 to 260 feet in width at Westpoint bar. A training dike 10,142 feet long has been constructed at Westpoint bar, and examinations of the channel made subsequent to its construction show that the channel dimensions obtained by dredging are now being maintained.

The maximum draft that could be carried through the channels on June 30, 1902, at low tide was about 20 feet. The mean range of tide is about 3 feet.

The work remaining to be done to complete the project is the dredging necessary to complete a channel 400 feet wide and 22 feet deep and the extension and maintenance of the dike.

A large and important commerce has been benefited by this improvement. Westpoint was for years the cotton-shipping point of the Southern Railway Company. In 1896 this company established a new shipping point near Norfolk, Va., and freight carrying on the York River fell off considerably.

While the amount of river commerce is still below what it was prior to 1896, extensive new industries have been and are being established at Westpoint, and there is a demand for the widening of the channels to their full projected width, with a depth of at least 20 feet.

The following table shows the tonnage of the river from 1888 to 1894:

Reported for—	Tons.	Reported for—	Tons.
1888	285,480	1892	345,559
1889	328,353	1893	351,390
1890	418,190	1894	379,808
1891	304,338		

Repeated efforts have been made to procure commercial statistics for years subsequent to 1894, but without success.

(*b*) *Occoquan Creek.*—Occoquan Creek is a tributary of the Potomac River, which it enters about 25 miles below Washington, D. C. The stream is navigable from its mouth, at Sandy Point, to the town of Occoquan, a distance of 4 miles.

At the time of the adoption of the original project in 1873 navigation was obstructed by three bars, designated as Lower Mud, Upper Mud, and Sand bars, over which but 1.2 feet could be carried at low tide. The project of 1873 provided for dredging channels 100 feet

wide and 5 feet deep through these three bars, and was modified in 1879, so as to include a new channel through and a dike at the Sand Bar, and the dredging of a channel of the above dimensions through Occoquan Bar. Four appropriations were made from 1873 to 1878 amounting to $25,000, and in 1880 the improvement was regarded as completed.

In compliance with the provisions of the river and harbor act of August 11, 1888, a new survey of the creek was made in 1889. The survey showed that the channels dredged through Lower Mud, Sand, and Occoquan bars had all filled in from 2 to 3 feet in depth since 1880. The act of September 19, 1890, appropriated $10,000 for improving the creek.

The project adopted December 5, 1890, for the new (present) improvement comprises the dredging of channels 6 feet deep and 100 feet wide through the four bars, except the lower 2,000 feet of the Lower Mud Bar, where the width is to be 150 feet, and the construction of dikes at Upper Mud, Sand, and Occoquan bars to maintain the depth obtained by dredging. The estimated cost of this project is $45,000.

The amount expended on the existing project to June 30, 1902, was $24,727.97, of which about $10,000 was applied to maintenance. This expenditure has resulted in dredging channels from 100 to 150 feet in width, and to a least depth of 6 feet through the four bars, and in the construction of 1,585 linear feet of dike at Occoquan Bar and Sand Bar.

The maximum draft that could be carried through the channels on June 30, 1902, at mean low tide was about 6 feet, and the width of the channels between 6-foot contours was 100 feet. The mean range of tide is about 2 feet.

The work remaining to be done to complete the project is extension of the dike at Sand Bar about 800 feet, construction of a dike at Upper Mud, and such dredging as may be necessary to restore the channel dimensions called for by the project. Owing to the action of freshets in the upper part and to the great width of the lower part of the stream, and cross-tidal currents in the latter, it is probable that occasional redredging will be required to maintain the depth, even after the essential features of the project shall be completed. The project is not, therefore, regarded as capable of permanent completion as regards dredging.

The work done under the appropriations for this improvement has been of material benefit to the trade and commerce connected with this locality by increasing the original ruling depth of 3 feet at low tide to 6 feet, thus obviating the delays due to waiting for tides and increasing the available draft of vessels navigating the creek. In this connection attention is invited to the appended comparative table of commercial statistics. The articles carried through the channel are mostly sand (for building), railroad ties, piles and wood, coal, fertilizers, flour and grain, and miscellaneous articles, being small in amount.

Receipts and shipments by water.

	Tons.		Tons.
1891	8,205	1898	29,865
1892	56,705	1900	69,400
1894	8,900	1901	20,220
1895	10,475		
1896	41,670	Total for nine years	261,275
1897	15,835		

Of the total tonnage, 105,600 tons was sand.

(*c*) *Lower Machodoc Creek.*—This creek is a tidal estuary on the right bank of the Potomac River, and about 85 miles below Washington, D. C. It has a navigable length of about 4 miles. The width between banks at the mouth is 1 mile and between the 12-foot contours the channel width exceeds 3,000 feet. The lower part of the creek for a distance of 1½ miles above the mouth is three-fourths of a mile to a mile in width, with a navigable depth of 13 feet, affording a safe harbor during northeast to southeast storms.

At the Narrows, 2 miles above the mouth, the stream suddenly contracts to a width of 650 feet, and the channel is obstructed by a sand bar over which but 4 feet could be carried at low tide. This bar has constituted the principal obstruction to navigation.

After passing Narrows bar a depth of 10 to 14 feet is found in the channel, gradually shoaling to about 9 feet near Cupelo Point, 3 miles above the mouth, and thence to about 6 feet at Drum Bay, the head of navigation, 4 miles above the mouth.

The present approved project, adopted November 29, 1892, provides for dredging a channel 150 feet wide and 9 feet deep at low tide through the bar at the Narrows. The estimated cost was originally $15,000. This estimate was revised in 1897 and reduced to $11,100.

The total expenditure to the close of the year ending June 30, 1902, was $8,824.12. It resulted in a dredged channel through Narrows bar 150 feet wide and 9 feet deep for about 1,150 feet (or about two-thirds of the length of the bar), the remaining third (575 feet) being dredged to a depth of 9 feet for a middle width of 110 feet, with a strip on each side 20 feet in width and 6 feet in depth. The portion of the above amount expended in maintenance (redredging) is estimated as $500.

The available funds being practically exhausted, no work of improvement was in progress during the past fiscal year.

The maximum draft that could be carried June 30, 1902, over the shoalest part of the locality under improvement was about 9 feet. The mean range of tide is about 1.7 feet.

The benefit to navigation and commerce from the work already done has been considerable, as large sailing vessels and regular lines of steamers now enter the creek, which was impossible previous to the improvement.

Repeated efforts have been made to obtain commercial statistics for this work, but without success.

(*d*) *Nandua Creek.*—[This work was in the charge of Maj. James B. Quinn, Corps of Engineers.] Before improvement the entrance channel to this creek was indirect, narrow, and sinuous, and could only be navigated at mean low water by vessels of 5 feet draft. Within the mouth the channel was sufficient for all commercial needs.

The existing project, approved May 11, 1899, is to secure a direct channel by dredging a distance of 1,200 feet through the bar at the mouth of the creek over a width of 100 feet to a depth of 8 feet at mean low water, at an estimated cost of $6,000.

June 30, 1902, the expenditures on account of this improvement amounted to $5,971.32, a channel 1,200 feet long, 75 feet bottom width, having been dredged to a depth of 8 feet at mean low water.

As anticipated, this channel has filled in so that the available draft which could be carried into the creek June 30, 1902, at mean low water, was limited by the shoaling to 5 feet 9 inches. The minimum

amount of commerce reported for any calendar year since the inception of the work of improvement was in 1900, when it only amounted to 1,167 tons. The maximum amount was in 1898, 8,550 tons.

(*e*) *Aquia and Carters creeks.*—Improvement of these streams was included in a lump sum of $16,000 appropriated by act of Congress of June 13, 1902, which sum also covered improvement of several other streams, the specific amounts to be allotted by the War Department. As recommendations for these allotments have to await the results of examinations of the streams now in progress, no more definite report can here be made.

July 1, 1901, balance unexpended	$3,770.18
Amount appropriated by river and harbor act approved June 13, 1902	16,000.00
	19,770.18
June 30, 1902, amount expended during fiscal year	2,672.61
July 1, 1902, balance unexpended	17,097.57
July 1, 1902, amount covered by uncompleted contracts	518.00

(See Appendixes K 5–7 and L 8.)

6. Nomini Creek, Virginia.—Nomini Creek enters the Potomac River about 82 miles below Washington. In 1872 its navigation was obstructed by a bar of oyster shells and sand at its mouth, over which but 3 feet depth could be carried. After passing the bar the stream widens, and 8 feet could be carried for about 3½ miles to Nomini Ferry, while 5 feet could be carried for about 6 miles above the mouth.

The project for improvement adopted in 1873 provided for dredging a channel through the bar 100 feet wide and 9 feet deep. In 1890 the project was finally modified and as follows, this modified project being the present one:

The dredged channel to be 150 feet wide and 9 feet deep; a jetty to be constructed from White Point on the east and one from Cedar Island on the west; dikes to be built inside White Point to check the cross currents. Estimated revised cost, $72,500. Examination made in 1897 showed that the east jetty should be made 400 feet longer, and that both jetties should be made higher than originally projected, the increased cost bringing the estimate up to $105,000.

The amount expended to include June 30, 1902, was $66,983.62, of which about $15,000 was applied to maintenance. It resulted in the dredging of the outer channel to a depth of 9 feet at mean low tide by a width of 140 to 150 feet, and the construction of 872 linear feet of the east jetty at a height of 4 feet above low tide.

The maximum draft that could be carried through the channel on June 30, 1902, at mean low tide was about 9 feet. The mean range of tide is 1.8 feet.

Total of freight transported through the channels under improvement, 1889–1898, was 196,110 tons; that for 1901 was 22,400 tons. The freight consisted of coal, farm produce, grain, lumber, oysters, railroad ties, general merchandise, and wood. The tonnage, by years, is given below.

The work required for completion of the project is extension of the east jetty 347 feet, beginning and building of the west jetty, and a small amount of redredging of the channel where slight shoaling has occurred.

Tonnage, by years.

	Tons.		Tons.
1889	13,542	1895	16,250
1890	15,825	1896	7,425
1891	62,300	1897	7,370
1892	21,000	1898	9,640
1893	17,658	1901	22,400
1894	25,100		

This statement is for sailing vessels only. The steamers carry the great bulk of grain and merchandise.

Repeated efforts were made to obtain commercial statistics for 1899 and 1900, but they could not be procured.

July 1, 1901, balance unexpended	$3,166.38
June 30, 1902, amount expended during fiscal year	150.00
July 1, 1902, balance unexpended	3,016.38

(See Appendix K 8.)

7. Rappahannock River, Virginia.—The Rappahannock River is navigable from its mouth in Chesapeake Bay to Fredericksburg, Va., a distance of 106 miles. The lower part of the river has the character of a tidal estuary, the width varying from 1 to 3.5 miles. The ruling depth at the mouth is 5 fathoms, and this depth holds to Jones Point, 28 miles above, while 17 feet can be carried to within 1 mile of Tappahannock, which is 41 miles from the mouth. Above Tappahannock the river has a tortuous course, and above Port Royal, 29 miles from Fredericksburg, it flows between high banks. The width at Fredericksburg is about 350 feet, gradually increasing to about 1,500 feet at Port Royal. In 1871, prior to the inception of the improvement, 6 feet could be carried to within a mile of Fredericksburg, and thence 4 feet to the town.

The obstructions to navigation before improvement was undertaken were nine bars between Tappahannock and Fredericksburg, over which the ruling depths were from 4 to 10½ feet. Seven of the bars were in the 12½ miles of river below Fredericksburg. Of these bars, Fredericksburg Bar, with a least depth of 4 feet, and Spottswood Bar, 4 miles below Fredericksburg, with a least depth of 6 feet, caused the most delay to steamboats and vessels.

The original project, approved in 1871, was to secure a channel 100 feet wide and 10 feet deep by dredging and the construction of dikes from Fredericksburg to Tappahannock, the wrecks obstructing the channel to be removed. The first estimate of the cost of this improvement was $83,760. In 1879 the project was amended so as to provide for dredging a channel 100 feet wide and 10 feet deep through the bars between Fredericksburg and Port Royal, and one 200 feet wide and 15 feet deep between Port Royal and Tappahannock, for a larger class of vessels; the depths secured by dredging to be maintained by a system of wing dams and training dikes to be built of piles and sheet piling, or of piles and brush or logs, the dikes being also required in some cases to secure the dredged material from being carried back into the river.

The total cost of the revised project, which is the present approved project, was estimated at $381,500.

The amount expended to June 30, 1902, was $265,964.91, of which about $75,000 has been applied to maintenance of channels and dikes. This expenditure resulted in the partial improvement of the seven bars

The amount expended to include June 30, 1902, was $32,722, of which about $10,000 has been applied to maintenance. It resulted in securing a channel 10 feet deep and 150 feet wide through the outer bar and a channel 10 feet deep and 135 feet wide through the inner bar, with a small turning basin 10 feet deep at the steamboat wharf.

A contract was made October 29, 1900, for about $720 worth of dredging at Urbana Creek (the funds being a small balance from appropriations) to be done under the same contract for certain dredging in York, Mattaponi, and Pamunkey rivers and Milford Haven, Va. The contractor has been engaged at other of the localities, and no dredging was done at Urbana Creek during the fiscal year ending June 30, 1902.

The maximum draft that could be carried through the channels on June 30, 1902, at low tide, was about 9.5 feet; the mean range of tide is 1.5 feet.

The improvement has been of benefit to commerce and navigation by permitting the entrance of sailing vessels to the creek and enabling one of the steamers of the Weems Line, Baltimore to Fredericksburg, to enter the creek and land at the wharf.

The value of the commerce and navigation of the stream is indicated by the following table of commercial statistics. The principal articles of commerce are oysters, railroad ties, coal, lumber, wood, farm produce, guano, and general merchandise.

COMMERCIAL STATISTICS.

Calendar year.	Reported by Mr. F. A. Bristow.	Reported by Mr. J. D. Gresdtt.
	Tons.	*Tons.*
1891	19,500	22,100
1892	20,095	17,125
1893	55,885	61,290
1894	82,395	88,305
1895	66,530	92,320
1896	137,485	133,925
1897	153,875	181,500
1900	179,513	179,414
1901	548,250	494,200

Commercial statistics received for 1898 and 1899 were not in a form to be used. These statistics are not regarded as entirely correct.

July 1, 1901, balance unexpended	$778.00
July 1, 1902, balance unexpended	778.00
July 1, 1902, amount covered by uncompleted contracts	720.00

(See Appendix K 10.)

9. Harbor at Milford Haven, Va.—Milford Haven is a tidal estuary of Chesapeake Bay, situated on its western shore, near Cherry Point, at the mouth of Piankatank River, and about 35 miles north of Old Point Comfort. The haven is about 4 miles long and from one-half to 1 mile wide. Its general direction is northwest and southeast. The depth in the channel ranges from 6½ to 15 feet, but is generally 7 feet or more. The haven has two entrances, one at the northwest end, at Hills Bay, an arm of the Piankatank River, about 2 miles from Cherry Point, and another at the southeast end, on Chesapeake Bay, about 5 miles below Cherry Point, thus separating from the main shore a considerable body of land known as Gwynns Island. Both entrances are obstructed by bars. The southeast entrance is exposed, and, as the bar has a ruling

depth of but 5 feet, is but seldom used. The northwest entrance, from Piankatank River, is the one generally used by vessels and steamers entering the haven, and before improvement the bar obstructing this entrance had a ruling depth of 8 feet.

The original—which is also the present—project for improvement was adopted by act of Congress of March 3, 1899, and proposed the dredging of a channel 10 feet deep, with a minimum width of 200 feet, through this bar, at an estimated cost of $12,500.

By act of Congress approved June 6, 1900, it was provided that—

> The unexpended balance of the appropriation for the improvement of the harbor at Milford Haven, Va., or any part thereof, may, in the discretion of the Secretary of War, be used for the improvement of the bar within said harbor.

This inner bar has a ruling depth of about 8 feet, but it was not included by the act of March 3, 1899, in the original survey or project, which provided only for the bar at the "entrance."

The amount expended to include June 30, 1902, was $8,891, none of which was applied to maintenance. It resulted in dredging the channel through the outer bar to the full dimensions required by the project. No work has been done on the inner bar.

A contract was made October 29, 1900, for dredging the inner bar under the same contract as for certain dredging to be done in York, Mattaponi, and Pamunkey rivers and Urbana Creek, Virginia. The contractor having been engaged at other of the above localities, no dredging has yet been done upon the inner bar, but it will be begun early in the next fiscal year.

The maximum draft that could be carried through the channels on June 30, 1902, at low tide was about 10 feet on the outer bar and about 8 feet on the inner bar. The mean range of tide is 1.3 feet.

The value of the commerce and navigation at this place may be seen by referring to the commercial statistics. The principal articles of commerce are oysters, farm produce, fish, flour, and general merchandise.

COMMERCIAL STATISTICS.

Tonnage for—	Tons.
1900	15,031
1901	16,856

July 1, 1901, balance unexpended	$3,609.00
Amount of judgment recovered	3,032.97
Amount appropriated by river and harbor act approved June 13, 1902	5,000.00
July 1, 1902, balance unexpended	11,641.97
July 1, 1902, amount covered by uncompleted contracts	1,920.00

(See Appendix K 11.)

10. Mattaponi River, Virginia.—The Mattaponi River is navigable for small steamers and vessels from its mouth to Aylett, about 39 miles, and can be made navigable for small barges from Aylett to Monday Bridge, 16 miles. At the time of the adoption of the project the obstructions to a 5½-foot navigation below Aylett consisted of seven bars, upon which the ruling depths at low tide varied from 2.4 to 3.8 feet. Above Aylett there were numerous bars, but no work upon them has been proposed. The river was also obstructed by snags, wrecks, and overhanging trees.

The original project for improvement, adopted in 1880, provided for removal of snags, wrecks, and leaning trees below Monday Bridge, and the improvement of the bars below Aylett, so as to give a depth of 5½ feet at low tide and a channel width of 40 feet. This project was extended by the terms of the river and harbor act of July 13, 1892, which provided for the removal of snags as far up as Guineas Bridge, near Milford Station, on the Richmond, Fredericksburg and Potomac Railroad. Estimated cost of this, which is the present project, $72,100.

The amount expended to June 30, 1902, was $29,162.71, of which about $8,000 was applied to maintenance. This expenditure resulted in the removal of snags, logs, and overhanging trees from the river, between Robinsons Bar, 34 miles above the mouth and Monday Bridge, 21 miles above Robinsons, and in keeping the river below Aylett free from such obstructions; in constructing 2,297 linear feet of dike at Robinsons Bar, and in dredging channels of the full projected dimensions entirely through Line Tree and nearly one-third of the distance through Latané Bar.

The maximum draft that could be carried at mean low water over the shoalest part of the channel June 30, 1902, was 2.4 feet, at Walker Bar. The mean range of tide is about 3 feet.

The work already done upon this river has been of benefit to the existing commerce, the amount of which is shown by the following table. As snags and other obstructions form in greater or less degree after every freshet, much of the work done has had to be gone over again. Before any work for improvement was undertaken the trade was limited.

Tonnage by years.

	Tons.		Tons.
1890	32,650	1894	39,300
1891	52,060	1899	44,700
1892	32,690	1900	42,500
1893	36,420	1901	12,054

Commercial statistics for the years 1895–1898 could not be procured.

July 1, 1901, balance unexpended	$4,111.24
June 30, 1902, amount expended during fiscal year	3,473.95
July 1, 1902, balance unexpended	637.29
July 1, 1902, outstanding liabilities	12.00
July 1, 1902, balance available	625.29
July 1, 1902, amount covered by uncompleted contracts	236.56

(See Appendix K 12.)

11. Pamunkey River, Virginia.—The Pamunkey River is navigable from its mouth at Westpoint, on York River, to Hanovertown, a distance of about 59 miles. At the time of the adoption of the project a draft of 7 feet could be carried at low water to Buckland Bar, 38½ miles above Westpoint. Above this bar there were six bars, extending along the river for about 15¼ miles, the ruling depths on which varied from 5½ to 2 feet. Besides these bars, the river was obstructed by wrecks, logs, snags, and overhanging trees.

The project for improvement, adopted in 1880 and amended in 1885, contemplates 7-foot navigation to Bassett Ferry, 47 miles from Westpoint; thence 5 feet to Wormley Landing, 54 miles; thence 3 feet to Hanovertown, the 7-foot channel to have a width of 100 feet and the other channels 40 feet. The wrecks, snags, logs, and trees obstructing navigation between Garlick Ferry and Hanovertown were also to be removed. The cost of this amended project, which is the present project, was estimated at $32,500.

The total expenditure to June 30, 1902, was $24,929.50, of which about $5,000 was applied to maintenance. This expenditure has resulted in removing snags and similar obstructions from about 30 miles of river, in removing parts of seven wrecks, in partly improving Spring and Skidmore bars, and in dredging a channel 100 feet wide and 7 feet deep through Buckland Bar, this latter work having been done during the past fiscal year.

The maximum drafts that could be carried through the channels on June 30, 1902, at mean low tide were as follows: In the 7-foot channel, 5.3 feet; in the 5-foot channel, 3.5 feet, and in the 3-foot channel, 2.2 feet. The mean range of tide varies from 2 to 3.5 feet.

The commerce of this river amounted, according to reports received, to 50,420 tons in 1893 and 42,250 tons in 1894, the greater part of the latter being railroad ties and wood. There is scarcely any trade on the 5 miles immediately below Hanovertown. The tonnage of the river for 1899 is stated as about 44,600 tons. Commercial statistics for the years 1895 to 1898 and for 1900 and 1901 could not be obtained.

The work remaining to be done to complete the existing project consists in dredging, construction of dikes, and removal of snags and logs.

July 1, 1901, balance unexpended	$2,875.17
June 30, 1902, amount expended during fiscal year	2,304.67
July 1, 1902, balance unexpended	570.50
July 1, 1902, amount covered by uncompleted contracts	173.57

(See Appendix K 13.)

12. James River, Virginia.—Improvement of this river was not regularly undertaken by the United States until 1870. At that time the condition of the river was about as follows:

Between the mouth of the Appomattox and Richmond, then a distance of 35 miles, instead of 30 miles, as at present, the canal at Dutch Gap not being navigable, the ruling depth at mean low tide was 7 feet, that depth obtaining on Rocketts Reef at Richmond and on Richmond bar, 2 miles below. The channel was close and indirect at some points, and was obstructed in Trents Reach, in the bend just above Dutch Gap, 17½ miles below the city, by a shoal on which only 8 feet could be carried and by obstructions placed during the civil war by the Federal authorities.

The channel was also obstructed by wrecks at Graveyard Reach and Chaffins Bluff, 10 miles and 8 miles respectively, below Richmond.

The channel at Drewry Bluff and Warwick Bar, situated about 7 and 4½ miles, respectively, below the city, was almost impassable on account of obstructions placed during the civil war, consisting at each locality of the remains of a military bridge, lines of stone cribs, and sunken vessels.

The ruling depth in the reach between the mouths of the James and the Appomattox, a distance of 69.4 miles, was 15 feet on Harrisons Bar,[a] about 38 miles below Richmond, and on Goose Hill Flats, 71 miles below.

The original project was to give 18 feet depth at full tide to Richmond, with a channel width of 180 feet from Harrisons Bar to the city docks, the excavation in rock to be to a depth of 18½ feet. The average rise of tide is 2½ feet. Work under this project had been well advanced when Congress, July 5, 1884, adopted another to afford 22 feet of depth at mean low tide from Richmond to the sea, the widths to be given the improved channels to be 400 feet from the sea to City Point, 300 feet thence to Drewry Bluff, 200 feet thence to Richmond. The consequent estimated cost of the improvement was $4,500,000. A large part of the excavation has been and will be through solid rock, the cost necessarily being heavy. Operations consist in dredging, rock excavation, and regulation of the waterway by means of dikes and jetties.

The work has generally been done first on the shoalest places in the channels, with a view to benefit of commerce.

The amount expended on the improvement, to include June 30, 1902, was $1,892,449.04. It has resulted in a channel with a ruling depth of 16½ feet at mean low tide for a general width of 90 to 100 feet from Hampton Roads to Richmond.

The maximum draft that could be carried on June 30, 1902, at mean low tide was 16½ feet. This least depth lies within the first mile below the lower city line of Richmond. Below this mile reach the ruling depth is 17 feet.

The available funds were not sufficient to enable the undertaking of any improvement work on an extended scale. Necessary examinations and channel surveys were made, and general work done in preparation for future operations.

The value to commerce of improvement of the river is shown by the following table of river tonnage between 1890 and 1901:

	Tons.		Tons.
1890	743,122	1897	661,909
1891	739,308	1898	472,778
1892	616,755	1899	571,802
1894	616,269	1900	609,411
1895	602,582	1901	652,451
1896	680,935		

July 1, 1901, balance unexpended	$51,029.75
Amount appropriated by river and harbor act approved June 13, 1902	300,000.00
	351,029.75
June 30, 1902, amount expended during fiscal year	20,978.79
July 1, 1902, balance unexpended	330,050.96
July 1, 1902, outstanding liabilities	931.00
July 1, 1902, balance available	329,119.96

(See Appendix K 14.)

[a] The United States Coast and Geodetic Survey chart of 1852 shows a depth of 13½ feet at Harrisons Bar. The United States Engineer chart of 1877, before which time no work had been done at the bar, shows 15 feet.

13. Protection of Jamestown Island, Virginia.—The river and harbor act of 1894 contained an item of $10,000 for protection of Jamestown Island. The shore of the island had been wearing away for years under the action of waves, and erosion had reached a point where protection was needed if the old landmark was to be preserved. The appropriation was applied to construction of a wall faced with granite laid without mortar, to grading and turfing the bank behind the wall, and to construction of several groins in front of it. This work was completed in 1895. The soil of the island is light. The funds did not admit of the kind of work desirable. Storms in the winter of 1895 and 1896 greatly damaged the work.

The river and harbor act of June 3, 1896, appropriated $15,000 for the protection. No work of construction, however, could be undertaken until satisfactory arrangements could be made whereby working parties could go upon the ground to be protected. Full understanding in that respect was finally arrived at and a contract for the new work made in December, 1900. The plan consisted of a revetment of closely laid flat concrete blocks with backing of macadam placed on the slope of the bank on which the revetment rested, the outer toe of embankment and revetment being buttressed by a line of piling connected by a string piece to which well-driven sheet piling was spiked. The work was completed November 16, 1901. Total length of new work built, 1,310 feet.

The protection of this island can not be said to be necessary to the improvement or conservation of the navigation of James River.

July 1, 1901, balance unexpended	$14,465.55
June 30, 1902, amount expended during fiscal year	14,143.40
July 1, 1902, balance unexpended	322.15

(See Appendix K 15.)

14. Removing sunken vessels or craft obstructing or endangering navigation—Sunken raft in Piankatank River, Virginia.—This raft having been reported as an obstruction to navigation an examination of the same was made January 7, 1902. The raft was regarded as an obstruction to navigation, and allotments amounting to $150 were made from the indefinite appropriation for removing sunken vessels or craft obstructing or endangering navigation, and the obstruction was successfully removed by hired labor in February, 1902, at a total expenditure of $114.80.

Wreck of bugeye Daisy in Carters Creek, Virginia.—This wreck having been reported as injurious to navigation an allotment of $50 was made May 1, 1902, for its examination. The officer in charge reported that the wreck was an obstruction to navigation and a further allotment of $200 for its removal was made June 5, 1902, from the indefinite appropriation for removing sunken vessels or craft obstructing or endangering navigation. The wreck will be removed at an early day.

(See Appendix K 16.)

IMPROVEMENT OF NORFOLK HARBOR, VIRGINIA, AND ITS APPROACHES, AND OF CERTAIN WATERWAYS AND HARBORS IN SOUTHEASTERN VIRGINIA AND NORTHEASTERN NORTH CAROLINA.

This district was in the charge of Maj. James B. Quinn, Corps of Engineers. Division Engineer, Col. Peter C. Hains, Corps of Engineers.

1. Harbor at Norfolk and its approaches, Virginia.—Originally the channel of the harbor was available at mean low water for vessels drawing 20 feet as far as the navy-yard, near Norfolk. To wharves on the Eastern Branch a good 15-foot channel at mean low water existed.

The project, approved in 1885, with amendments of 1890, covers the attainment of a channel 25 feet deep at mean low water from Hampton Roads to the navy-yard, and 22 feet deep at the same stage of the tide in the Eastern Branch as far as the Campostella Bridge, dredging to be carried to within 75 feet of the pierhead lines on each side of the the river, above the mouth of the Western Branch, and below it over a width of 500 feet. An anchorage was also provided by dredging an area of 56 acres to a depth of 25 feet at mean low water.

Under a project adopted July 21, 1898, a channel having a depth at mean low water of 28 feet over a width of 450 feet was excavated from deep water in Hampton Roads to the navy-yard, at an expense of $359,516.42.

As further amendments to the existing project, the act of June 13, 1902, provides for the cutting away of 400 feet of Hospital Point, and the removal of a shoal to 28 feet depth at mean low water in front of the wharves at Pinner Point, increasing the cost by $213,957, or to $1,255,701.56.

With the expenditure of $981,747.05, all of the work projected has been finished, with the exception of dredging between the Norfolk and Western Railway and Campostella bridges, which is not warranted by present commercial interests, the removal of a portion of Berkley Flats, the excavation contemplated in front of the wharves at Pinner Point, and the cutting away of Hospital Point. A vessel of 28 feet draft could navigate the channel at mean low water to the navy-yard, and, in Eastern Branch, a vessel drawing 22 feet could go as far as the Norfolk and Western Railway bridge, at mean low water. The tidal variations average 2.7 feet.

The commerce is general in character. In 1888, 1,914,506 tons was transported by water, and this amount has gradually increased, with two exceptions, to 7,761,356 tons in 1901.

July 1, 1901, balance unexpended	$3,467.23
Amount appropriated by river and harbor act approved June 13, 1902	30,000.00
	33,467.23
June 30, 1902, amount expended during fiscal year	214.28
July 1, 1902, balance unexpended	33,252.95
Amount (estimated) required for completion of existing project	240,731.56
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	183,957.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix L 1.)

2. Western Branch of Elizabeth River, Virginia.—The channel of the river, when the project for improvement was adopted, was 12 feet deep at mean low water, and 50 to 300 feet wide.

The adopted project provided for obtaining, by dredging, a channel 200 feet wide and 20 feet deep at mean low water from deep water in Norfolk Harbor for a distance of about 1 mile, at an estimated cost of $45,000. This project was approved September 2, 1896.

The sum of $44,666.73 had been expended on the improvement to June 30, 1902, the result being the completion of the project.

A draft of 20 feet could be carried, at mean low water, in the improved channel at the close of the past fiscal year. The average rise and fall of the tide is 2.7 feet.

The commerce, in the main, consists of manufactured lumber and farm products, and has increased from 211,653 tons in 1896 to 1,383,105 tons in 1901.

The channel is ample in depth, but it may be necessary to widen it in the near future to accommodate the increasing commerce.

July 1, 1901, balance unexpended	$373.77
June 30, 1902, amount expended during fiscal year	40.50
July 1, 1902, balance unexpended	333.27

(See Appendix L 2.)

3. Hampton Roads, Virginia.—The first appropriation for this work was made in the act of June 13, 1902. The existing channel, over the width it is proposed to excavate, has a minimum depth at mean low water of 25½ feet. The rise and fall of tides averages 2.6 feet.

The project for improvement adopted by the act of June 13, 1902, is printed in House Doc. No. 93, Fifty-sixth Congress, first session, and reprinted in the Annual Report of the Chief of Engineers for 1900, page 1785 et seq. The estimated cost of the work contemplated is $225,000.

No expenditures have been made to June 30, 1902.

The commerce to be benefited is quite extensive, and includes foreign and coastwise trade. The amount of freight transported in the calendar year 1901 amounted to 3,736,443 tons. Funds provided for work under the authorized continuing contract will be applied to the excavation of a channel 30 feet deep at mean low water over a width of 500 feet, from a 30-foot depth in Hampton Roads to a 30-foot depth off Newport News Point, the course of the channel to follow the present deepest water to the south of the Middle Ground light-house.

Amount appropriated by river and harbor act approved June 13, 1902	$10,000.00
July 1, 1902, balance unexpended	10,000.00
Amount (estimated) required for completion of existing project	215,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	215,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix L 3.)

4. Nansemond River, Virginia.—In its original condition there was a 5-foot channel, obstructed by wrecks and snags. At a cost of $37,000 an 8-foot mean low-water channel was provided between 1873 and 1878.

The existing project, approved December 18, 1888, is to secure a channel 12 feet deep at mean low water from Suffolk, Va., to Town Point, 100 feet wide on the bottom from the former place to the Western Branch, and from 200 to 400 feet wide at the bottom thence to Town Point. It also provides for a turning basin 200 feet square a short distance below Suffolk. Estimated cost, $152,500.

As stated in the last annual report (p. 293), a channel 80 feet wide and 12 feet deep at mean low water is deemed sufficient for commercial uses.

June 30, 1902, the expenditures under the existing project had amounted to $140,130.06.

The channel provided was 80 feet wide and 12 feet deep at mean low water between Suffolk and the Western Branch. The turning basin was also excavated at Suffolk, as projected. The draft that can be carried in the channel at mean low water is limited by a shoal below the Western Branch dike to 8 feet. The tides vary 3 feet at Town Point and 3.8 feet at Suffolk, Va.

The commerce is general in character, but since the inception of the existing project the statistics furnished have not, with four exceptions, indicated it in full, so that no accurate comparison can be made from year to year. It is manifest, however, that the freight handled each year is gradually decreasing, although still of such proportion as to warrant removing the shoals which now limit the draft of vessels using the stream.

July 1, 1901, balance unexpended	$9,869.94
July 1, 1902, balance unexpended	9,869 94
July 1, 1902, outstanding liabilities	9.75
July 1, 1902, balance available	9,860.19

(See Appendix L 4.)

5. Pagan River, Virginia.—This stream was obstructed by shoals which limited the draft of vessels to 6½ feet at mean low water.

Under appropriations made in 1880 and 1881, aggregating $10,000, a channel 60 feet wide and 8 feet deep at mean low water was excavated through three of the four obstructing bars between the mouth of the river and Smithfield, Va., by the expenditure of that amount, under a project submitted August 26, 1880.

The project for improvement adopted by the act of June 13, 1902, is printed in House Doc. No. 88, Fifty-sixth Congress, second session, and in the Annual Report of the Chief of Engineers for 1902, page 1474.

The estimated cost of the dredging contemplated at present is $28,870, which, it has been assumed, will be sufficient to excavate a channel 80 feet wide and 8 feet deep at mean low water through five shoals which exist between the mouth of the river and Smithfield, Va.

To the close of the past fiscal year no expenditures had been made and no work performed.

On June 30, 1902, vessels were limited to a draft of 6½ feet at mean low water by the shoalest spot within the creek. The average variation of the tide is 2.6 feet, both at Smithfield, Va., and at the mouth of the river.

No comparison can be made of the yearly commerce. In the calendar year 1901, 108,058 tons of freight was transported on the river.

Amount appropriated by river and harbor act approved June 13, 1902...	$10,870.00
July 1, 1902, balance unexpended	10,870.00

(See Appendix L 5.)

6. Appomattox River, Virginia.—The channel of this stream prior to improvement was narrow and tortuous. Numerous shoals prevented vessels drawing over 6½ feet from navigating the river at its mean high-water stage.

Under the existing project, approved in 1893, a channel 80 feet wide and 12 feet deep at mean high water is contemplated, at a cost of $473,920, and $10,000 annually for maintenance.

Under the item in the act of June 13, 1902, providing for the diversion of the freshet water of the river at Petersburg, Va., the estimated cost will be increased $200,000.

The amount expended to June 30, 1902, was $438,819.37, of which the sum of $14,989.37 was applied to maintaining the channel and repairing regulating works.

Every freshet causes sand to be deposited in the river bed and limits the draft of vessels which can safely use the river to that of the least depth of water over the shoals thus formed. The channel depth June 30, 1902, did not exceed 9 feet at mean high water, due to shoals which have been formed by freshets, and vessels were limited to this draft. The range of the tide averages 2.6 feet at Petersburg and 2.7 feet at Point of Rocks.

The commerce has increased from 30,626 tons in 1888 to 145,509 tons in the calendar year 1901.

July 1, 1901, balance unexpended	$21.97
Amount appropriated by river and harbor act approved June 13, 1902...	32,500.00
	32,521.97
June 30, 1902, amount expended during fiscal year	11.34
July 1, 1902, balance unexpended	32,510.63
July 1, 1902, outstanding liabilities	9.63
July 1, 1902, balance available	32,501.00
Amount (estimated) required for completion of existing project	223,090.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	175,000.00

Submitted in compliance with the requirements of sundry civil act of June 4, 1897.

(See Appendix L 6.)

7. Harbor at Cape Charles City, Va.—This harbor is situated 12 miles north of Cape Charles, on Chesapeake Bay, and is a basin of about 10 acres area. This artificial harbor and the approaches by channel to it originally had a good, navigable 12-foot mean low-water channel.

The project covering the plan of improvement was approved November 13, 1892, and contemplates dredging the harbor to a depth of 14 feet, and the entrance thereto and the channels in Cherrystone Inlet and across Cherrystone Bar to a depth of 16 feet at mean low water, the widths at the inlet and the bar to be 100 and 200 feet, respectively, with jetties of stone to protect the entrance to the harbor. The estimated cost of the improvement is $143,340.

June 30, 1902, the total expenditures under the existing project had amounted to $54,707.26, the improvement effected thereby embracing

the dredging of about one-half of the area of the harbor to a depth of 14 feet at mean low water, excavating channels of the proper dimensions at the entrance to same and through Cherrystone Inlet and Bar to 16 feet at mean low water, the construction of 875 feet of the north jetty and 244 feet of the south jetty, of which the outer 12 feet of the latter is only about two-thirds finished.

The commerce of the harbor has steadily increased since 1890, when it amounted to 390,207 tons. In the calendar year 1901, 940,646 tons of freight was transported. The channel depth at the entrance on June 30, 1902, was only 10 feet at mean low water. A vessel of that draft could reach the wharves within the harbor at the stage of the water level above stated.

July 1, 1901, balance unexpended	$292.74
Amount appropriated by river and harbor act approved June 13, 1902	20,000.00
July 1, 1902, balance unexpended	20,292.74
July 1, 1902, outstanding liabilities	5.25
July 1, 1902, balance available	20,287.49

(See Appendix L 7.)

8. Waterway from Norfolk, Va., to the sounds of North Carolina.—This waterway is composed of Deep Creek, a branch of the Southern Branch of the Elizabeth River, 5½ miles above the Norfolk navy-yard; the Dismal Swamp Canal, extending from Deep Creek to South Mills; Turners Cut, which is artificial and connects the canal with the Pasquotank River, North Carolina, thence by the latter to Albemarle Sound, which connects with Pamlico Sound through Croatan Sound.

The prevailing channels in Deep Creek, the canal (which is the property of a corporation), and Turners Cut before improvement were 2½ feet in depth at mean low water. In the Pasquotank River and Croatan Sound vessels of 8 and 10 feet draft, respectively, could be accommodated.

The project for improvement, approved May 11, 1899, calls for a channel from the entrance of Deep Creek into the Southern Branch of the Elizabeth River to the locks of the Lake Drummond Canal and Water Company, 100 feet wide and 10 feet deep at mean low water; the excavation of Turners Cut and the protection of its banks from caving from the point where Joyces Creek crosses it to the Pasquotank River, to a surface width of 100 feet and depth of 10 feet at mean low water; the removal of obstructing points and a bar at Shipyard Landing in the Pasquotank River to a depth of 10 feet, and in dredging to 12 feet at mean low water through the bar off Croatan light over a width of 200 feet. The estimated cost of the work contemplated was $274,310.

On this work to June 30, 1902, the sum of $241,518.75 had been expended.

The work which has been done includes the dredging of Deep Creek, Turners Cut, the Pasquotank River, and Croatan Sound, as projected, and the placing of 17,775 linear feet of bank protection in Turners Cut. The channel excavated in Deep Creek shoaled slightly, and when the portion which it will be necessary to redredge has been given the proper depth all the work contemplated under the existing project will have been performed. The redredging mentioned will be arranged for under a contract which will be executed early in the next fiscal year.

At mean low water on June 30, 1902, a vessel drawing 10 feet of water could navigate the waterway. The tide ebbs and flows only in the Deep Creek section of the improvement, the rise and fall averaging 3 feet. In the other portions of the waterway the variations in the water level average about 0.5 foot, and are due to the force and direction of the wind.

The partial value of the commerce in 1900 was $710,140, with 23,114 tons miscellaneous freight of which the value was not known. The commerce of the calendar year 1901 was valued at $1,485,409, and amounted to 214,263 tons.

July 1, 1901, balance unexpended	$139,345.41
June 30, 1902, amount expended during fiscal year	125,994.16
July 1, 1902, balance unexpended	13,351.25

(See Appendix L 9.)

9. Inland water route from Norfolk, Va., to Albemarle Sound, North Carolina, through Currituck Sound.—This route from Norfolk, Va., to Albemarle Sound, North Carolina, is by way of the Southern Branch of Elizabeth River, Albemarle and Chesapeake Canal, North Landing River, Currituck Sound, Coanjock Bay, North Carolina Cut, and North River. The canal mentioned and the North Carolina Cut are controlled and maintained by a private corporation.

The route originally had a good 5-foot mean low-water channel, which was obstructed by snags, sunken logs, and overhanging trees. Sharp bends added to the other difficulties of navigation.

Separate projects for the above-mentioned natural waters were under execution prior to the act of September 19, 1890, when an appropriation for the different works was made in one item. The existing project, approved September 30, 1890, calls for a channel 80 feet wide and 9 feet deep at mean low water, at an estimated cost of $306,667.08.

Before the works were consolidated $240,169.69 had been expended, and since then to June 30, 1902, the sum of $46,999.68 had been expended. With these expenditures a channel 60 to 80 feet wide and 9 feet deep at mean low water has been secured through the several sections comprising the waterway, and at the close of the fiscal year a vessel drawing 8 feet could navigate the route at mean low water, being restricted to that limit by the Albemarle and Chesapeake Canal, which is capable only of accommodating vessels of that draft.

There is no lunar tide, except in the Southern Branch of Elizabeth River. For the other sections the stage of the water depends upon the velocity and direction of the winds, which cause some slight variations. In the Southern Branch of the Elizabeth River the rise and fall of the tide averages 2.7 feet at the locks of the Albemarle and Chesapeake Canal.

The commerce by way of this route in 1890 was the largest reported, amounting to 403,111 tons. The minimum was in 1898, amounting to 188,573 tons. During the calendar year 1901 210,264 tons was carried through this waterway.

July 1, 1901, balance unexpended	$5,056.46
Amount appropriated by river and harbor act approved June 13, 1902	23,400.00
	28,456.46
June 30, 1902, amount expended during fiscal year	5,056.14
July 1, 1902, balance unexpended	23,400.32

(See Appendix L 10.)

10. Edenton Bay, North Carolina.—The navigation of this bay was obstructed by a hard sand shoal having 6½ feet of water over it at mean low water. In 1878 and 1879 the Government dredged a channel 100 feet wide and 9 feet deep at mean low water at an expense of $5,000.

The existing project was approved in 1885, and requires that a channel from 150 to 200 feet wide and 9 feet deep at mean low water shall be secured, and a turning basin covering an area of 12 acres provided. The estimated cost of this work was stated at $18,000.

Under the present project the sum of $11,859.37 had been expended in dredging, giving a 9-foot depth at mean low water over a width of from 150 to 200 feet, and 9½ acres of the turning basin excavated to the same depth.

At the close of the fiscal year a boat drawing 8½ feet could navigate the dredged channel at mean low water. The draft is restricted about one-half foot by shoaling which has occurred at the entrance to the dredged channel. The slight difference in the water level is due to force and direction of wind.

The commerce in 1898 amounted to 160,109 tons. For the calendar year 1901 the commerce amounted to 212,950 tons.

July 1, 1901, balance unexpended	$178.08
Amount appropriated by river and harbor act approved June 13, 1902	6,000.00
	6,178.08
June 30, 1902, amount expended during fiscal year	37.45
July 1, 1902, balance unexpended	6,140.63

(See Appendix L 11.)

11. Roanoke River, North Carolina.—In its original condition a draft of 10 feet could be carried to Indian Highland Bar, 67 miles above the mouth, and thence 2½ feet to Weldon, at ordinary low water. The river, however, was badly obstructed by wrecks, snags, logs, and stumps, and trees overhanging the river interfered seriously with the passage of vessels.

The project approved in 1871 is to provide, at all seasons of the year, a channel with a least width of 50 feet from Hamilton to Weldon, 5 feet deep at mean low water, and to clear the river below the former place for the accommodation of vessels navigating the sounds of North Carolina. Estimated cost of work contemplated, $269,000.

The expenditures made under the existing project to June 30, 1902, amounted to $218,732.23.

By the expenditure of the amount reported above the obstructions in the channel below Hamilton were removed and a channel of 4 feet depth at mean low water provided between the said place and Weldon. At the normal stage of water in the river a draft of 10 feet can be carried from the mouth to Hamilton, and 4 feet thence to Weldon. The variations in depth of channel are caused by freshets in the upper river, which at times cause a rise of over 40 feet. The lower river is not affected to such a great extent by freshets, and at Plymouth, N. C., the variation is almost entirely due to the wind, which causes a rise or fall of about 1 foot, according to direction and velocity.

The commerce in 1870 amounted to 150,000 tons. In 1891 it was given at 376,181 tons. Since the time last stated, and until the present year, it has not been possible to obtain all the data to present a com-

plete statement of it. For the calendar year 1901 the commerce is shown to have amounted to 226,736 tons.

A small amount of dredging will be required in the vicinity of Weldon to accommodate the traffic to that point. This work will be quite expensive, as the material to be excavated is rock and gravel, and blasting will be necessary in connection with dredging.

July 1, 1901, balance unexpended	$15,781.11
June 30, 1902, amount expended during fiscal year	5,175.34
July 1, 1902, balance unexpended	10,605.77

(See Appendix L 12.)

12. Removing sunken vessels or craft obstructing or endangering navigation.—(*a*) *Wreck of barge Kingston.*—This wreck was in Turners Cut, about 1¼ miles below South Mills, N. C., and was removed at a cost of $155, under a proposal submitted in response to a public notice.

(*b*) *Wrecks of barges East New Market and Centennial.*—These wrecks were in the Southern Branch of the Elizabeth River, Virginia, the former a short distance off of Frey's wharf, Berkley, and the latter about 1,600 feet below the bridge of the Belt Line Railway.

Both were removed at a cost of $535, under a proposition made under a public notice inviting proposals.

(See Appendix L 13.)

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN NORTH CAROLINA.

This district was in the charge of Capt. E. W. Van C. Lucas, Corps of Engineers. Division Engineer, Col. Peter C. Hains, Corps of Engineers.

1. Scuppernong River, North Carolina.—Prior to 1887, $8,000 had been expended under a project to provide a channel 9 feet deep and 60 feet wide up to Spruill's bridge.

The navigable part of this river, 18 miles long, extends from Spruill's bridge, near Creswell, Washington County, through the western part of Tyrrell County to Albemarle Sound, which it enters from the south shore about 20 miles east of Roanoke River light. The depth on the bar at the mouth is about 6 feet in a very narrow channel.

The project adopted by act of June 13, 1902, provides for dredging a channel 3,400 feet long, 9 feet deep, and 150 feet wide across the bar at the mouth, at an estimated cost of $14,000.

The adopted plan is printed in House Doc. No. 131, Fifty-sixth Congress, second session, and in the Annual Report of the Chief of Engineers for 1901, page 1543.

Amount appropriated by river and harbor act approved June 13, 1902	$10,000
July 1, 1902, balance unexpended	10,000

2. Ocracoke Inlet, North Carolina.—The original condition was as follows: Between Pamlico Sound and the inlet was a fan-shaped shoal, over which were several channels, the best of which afforded a high-water depth (in 1830) of 5 feet. These shoals are constantly shifting and the practicable depth varies, when left to natural causes, between 5 and 8 feet at high water. The channel over the ocean bar is much better, and has probably for many years had an average low-water depth of about 12 feet.

The original project of 1827 was to obtain a channel through the inner shoals 400 feet wide and 10 feet deep at high water. Dredging under this project began in 1830 and resulted in deepening to 8.5 feet for partial width, but the project was abandoned in 1837 after the destruction of a maintenance jetty and the shoaling of the dredged cut.

The project of 1889 was to dredge through the Wallace Channel shoals a channel 300 feet wide and 10 to 15 feet deep at low water. In May, 1894, it was modified to dredge the Teachs Hole-Swash route for a width of 400 feet and depth of 9 feet. July 9, 1894, it was again modified to dredge the Wallace Channel route for a width of 300 feet and a depth of 9 feet. This project was completed in 1896.

There is no existing project, work of recent years having been restricted to occasional surveys to note channel changes for possible future use.

Expenditures.

On project of 1827	$133,732.40
Carried to surplus fund	17.60
	133,750.00
On project of 1894	87,616.97
On examinations since 1896	8,909.50
	96,526.47

Since the completion of the 1894 project, the dredged cuts have deteriorated and the governing depth therein is 5 feet or less. The best route is the old one over the Swash, where the governing high-water depth is 7 feet. The tidal range varies from 3.5 feet on the ocean bar to 0.2 foot on the shoals nearest Pamlico Sound.

The commerce during 1901 was not obtained, but it had decreased from 50,000 tons in 1896 to less than 5,000 in 1900. There is no apparent demand for any further work at the present time.

July 1, 1901, balance unexpended	$9,035.87
June 30, 1902, amount expended during fiscal year	562.34
July 1, 1902, balance unexpended	8,473.53

(See Appendix M 1.)

3. Fishing Creek, North Carolina.—Distance from mouth to Beach Swamp, 17.5 miles; Coffield's bridge, 21.3 miles; Wilmington and Weldon Railroad bridge, 40 miles; Bellamy's mill, 44 miles.

When improvement began the stream was badly obstructed by masses of fallen timber, and was navigable by rafts only a few miles above the mouth.

The original project of 1889 was to clear the stream up to Bellamy's mill of logs, snags, trees, etc. It was amended in 1896 to limit the work to that part below the Wilmington and Weldon Railroad bridge, and completed in 1901.

The existing project, approved July 2, 1902, is to maintain the natural channel to Beach Swamp, at an estimated annual cost of $2,000.

Expenditures.

On previous project, to June 30, 1902	$22,715.50

to Smithfield; extended in 1902 to include dredging to 8 feet depth at dead low water for 300 feet width below Newbern and 200 feet width at Newbern at an estimated cost of $24,000.

Expenditures.

To June 30, 1902—	
For improvement	$298,257.59
For maintenance	8,207.25
	306,464.84

All war blockades have been cleared away and the natural channel has been cleared as far as Smithfield, the clearing being generally maintained as far as Goldsboro, when funds were available. The present governing depths are 8 feet to Newbern at ordinary low water, 4 feet about 25 miles farther and 1 foot to Kinston. Navigation farther than 25 miles above Newbern is practicable only during high stages. The water level at and below Newbern varies about 3 feet, depending on the direction of the wind. Above Newbern the stream is subject to freshets, which during the winter months rise about 10 or 15 feet at Kinston.

The commerce during 1901 amounted to 320,950 tons, a gain over last year of 86,838 tons, and consisted principally of lumber, timber, general merchandise, fertilizers, cotton, and other farm products. It is proposed to maintain the channel above Newbern and to deepen to 8 feet at dead low water the channel at and below Newbern.

(*b*) *Trent River.*—Distances from mouth, at Newbern, to Pollocksville, 18 miles; to Lower Quaker Bridge, 27 miles; to Trenton, 38 miles.

Its original condition was a channel of 6 feet depth to Pollocksville, and the stream was fairly clear to Lower Quaker Bridge, above which point it was badly obstructed.

The original project of 1879 was to secure 3 feet depth at low water to Trenton; extended in 1886 to obtain 8 feet depth through Foys Flats; extended in 1889 to clear out obstructions to Upper Quaker Bridge, 40 miles above Trenton.

The existing project of 1896 is to maintain a channel 30 feet wide and 3 feet deep from Newbern to Trenton at an annual estimated cost of $2,500, extended in 1902 to include dredging at Newbern to 8 feet depth at dead low water from harbor line to channel. at an estimated cost of $24,000 additional.

Expenditures.

On previous projects	$64,262.64
On present project to June 30, 1902	4,669.03

The improvement above Trenton has been abandoned; below Trenton a channel 30 feet wide and 3 feet deep at low water has been obtained and maintained whenever funds were available. The present governing depth to Trenton is 3 feet. Near the mouth the water level varies about 3 feet according to the prevailing wind. At Trenton the stream is subject to freshets of about 3 to 5 feet during the winter months.

The commerce during 1901 amounted to 166,987 tons, an increase of 36,825 tons over the previous year, and consisted principally of lumber, general merchandise, fertilizers, cotton, and other farm products.

In addition to maintenance of present channel to Trenton, the work proposed is to make available the channel between the harbor line at Newbern and the deep river channel.

July 1, 1901, balance unexpended	$506.58
Amount appropriated by river and harbor act approved June 13, 1902	20,000.00
	20,506.58
June 30, 1902, amount expended during fiscal year	403.09
July 1, 1902, balance unexpended	20,103.49
July 1, 1902, outstanding liabilities	57.48
July 1, 1902, balance available	20,046.01

(See Appendixes M 5 and 6.)

7. Inland waterway between Newbern and Beaufort, N. C. (via Neuse River, Clubfoot Creek, Clubfoot and Harlowe Canal (private), Harlowe Creek, and Newport River).—Distances: Newbern to Clubfoot Creek, 21 miles; thence to Clubfoot and Harlowe Canal, 5 miles; thence to Harlowe Creek, 2¾ miles; thence to Newport River, 3¼ miles; thence to Beaufort, 7 miles.

When improvement began in 1885 the governing low-water depth was 1 foot.

The original project of 1884, as continued to date, is to obtain 5 feet depth and 30 feet width at an estimated cost of $92,000.

Expenditures.

To June 30, 1902	$28,696.33

The governing depth in the approaches to the canal was increased to about 5 feet several years ago, but for lack of maintenance has shoaled to about 1½ feet; the depth in the canal is only about 2 feet. The water level varies at the Harlowe Creek end, where there is a tidal range of about 1½ feet, and at the Clubfoot Creek end, where there is a variation of level of 1 to 2 feet, due to wind.

The commerce for 1901 could not be obtained, the canal company's record having been abandoned, but is presumably the same as in 1900—about 40,000 tons. It consists almost entirely of timber and lumber. No additional work is proposed until the private canal has been ceded or sold to the United States.

July 1, 1901, balance unexpended	$6,455.40
June 30, 1902, amount expended during fiscal year	151.71
July 1, 1902, balance unexpended	6,303.69

(See Appendix M 7.)

8. Harbor at Beaufort, N. C.—When improvement (begun in 1836) was resumed in 1881 the erosion at the throat of the inlet was causing serious deterioration of the inside channel and threatening deterioration of the bar channel. The governing low-water depths were 15 feet on the bar and 2 feet to Beaufort.

The original project of 1881 was to stop the erosion at the inlet by jetties at Fort Macon and Shackleford Point, and to dredge to 9 feet depth at low water and 200 feet width the channel from the Bulkhead Channel to Beaufort, and to 6 feet depth and 100 feet width the channel from North River to Beaufort; modified in 1887 by postponing

the dredging from North River and by reducing the proposed dimensions of Bulkhead Channel to 5 feet depth and 100 feet width; modified in 1890 by increasing the proposed depth of the Bulkhead Channel to 7 feet. As amended this project is completed.

The existing project of 1896 includes the maintenance of jetties and sand fences at Fort Macon and Shackleford Point, and the maintenance of channel across Bulkhead Shoal to Beaufort Harbor.

Expenditures.

On previous projects	$148,845.32
On present project to June 30, 1902	6,129.42

The erosion at the inlet has been stopped and the sand banks at Fort Macon and Shackleford Point have been built up and strengthened by means of sand fences. The 7-foot channel across Bulkhead Shoal has deteriorated to a present low-water depth of not over 3 feet. The governing low-water depths are 13 feet on the bar and 3 feet to Beaufort. The tidal range varies from about 3½ feet at the inlet to about 2 feet at Beaufort.

The commerce for 1901 amounted to 72,183 tons, an increase of 32,827 tons over 1899, the last year reported, and consisted of oysters, fish, lumber, and farm products. It is proposed to maintain the sand fences at Fort Macon and Shackleford Point and to restore the project depth across Bulkhead Shoal to Beaufort.

July 1, 1901, balance unexpended	$99.23
Amount appropriated by river and harbor act approved June 13, 1902	3,000.00
	3,099.23
June 30, 1902, amount expended during fiscal year	73.97
July 1, 1902, balance unexpended	3,025.26
July 1, 1902, outstanding liabilities	3.79
July 1, 1902, balance available	3,021.47

(See Appendix M 8.)

9. Inland waterway between Beaufort Harbor and New River, North Carolina.—Distances: From Beaufort to Swansboro, 30 miles; to New River, 52 miles, with access at Swansboro to the Atlantic Ocean through Bogue Inlet.

When improvement began in 1886, the governing low-water depth was 18 inches to Swansboro, and 6 inches thence to New River.

The project of 1885, as modified in 1896 and continued to date, is to obtain a channel 3 feet deep and 60 feet wide from Beaufort to Swansboro. No project was adopted for the part beyond Swansboro, pending repeal of act of North Carolina legislature granting to private parties exclusive navigation privileges, which have now expired by limitation.

The expenditures to June 30, 1902, amounted to $42,550.36.

Since the adoption of the project the channel has been dredged to 3 feet depth and a width of from 40 to 100 feet, but has deteriorated for lack of maintenance, the governing low-water depth being about 2 feet. The tidal range at Beaufort and Bogue Inlet is about 3½ feet, and decreases to a few inches in the middle of Bogue Sound.

The commerce for 1901 amounted to 33,917 tons, a gain over 1899, the last year reported, of 12,669 tons, and consisted principally of lumber, fish, and farm products. It is proposed, with the funds now available, to complete the existing project.

July 1, 1901, balance unexpended	$955.66
Amount appropriated by river and harbor act approved June 13, 1902	9,500.00
	10,455.66
June 30, 1902, amount expended during fiscal year	6.02
July 1, 1902, balance unexpended	10,449.64

(See Appendix M 9.)

10. New River, North Carolina.—When improvement began in 1886 the governing low-water depth was 4 feet and the channel included two circuitous parts around Wrights Island and Cedar Bush Marsh.

The original project of 1886 was to dredge a cut 4 feet deep and 100 feet wide through Wrights Island and a second cut 4 feet deep and 150 feet wide through Cedar Bush Marsh. Both were completed, but the Cedar Bush Marsh cut deteriorated at the upper end and was abandoned, and the project of June 18, 1894, to obtain 4 feet depth around Cedar Bush Marsh by dredging and training wall was adopted and successfully carried out. This latter channel has since deteriorated to the original condition through lack of maintenance.

There is no existing project, and no work has been done since the completion of the 1894 project.

The expenditures to June 30, 1902, amounted to $29,628.74.

Project depth has been twice obtained and twice lost through lack of maintenance. The present governing depth is about 2½ feet in a narrow, crooked channel with very little tidal rise. The tidal range at the inlet is about 3½ feet and at Cedar Bush Marsh it is about 1 foot.

The commerce during 1901 amounted to 3,556 tons, an increase of 310 tons over the preceding year, and consisted principally of naval stores, fish, and general merchandise. No additional work is proposed until the examination and survey directed by the river and harbor act of June 13, 1902, have been made.

July 1, 1901, balance unexpended	$3,371.26
July 1, 1902, balance unexpended	3,371.26

(See Appendix M 10.)

11. Northeast and Black rivers, and Cape Fear River above Wilmington, N. C.—(*a*) *Northeast River.*—Distance from mouth, to Bannerman's bridge 48 miles, Hallsville 88 miles, Kornegay's bridge 103 miles.

The original condition when improvement began was a channel badly obstructed by logs, snags, and overhanging trees. The river was navigable to Bannerman's bridge, with governing low-water depth of 6 feet.

The original project of 1889 is still in force and includes the clearing of the natural channel for small steamers to Hallsville, and for pole boats to Kornegay's bridge, at an estimated cost of $30,000.

Expenditures.

On project to June 30, 1902—	
For improvement	$10,687.96
For maintenance	6,550.69
	17,238.65

The result obtained has been a cleared channel whenever funds were available, permitting navigation at all stages to Bannerman's bridge, and during high water to Hallsville, the governing low-water depth

being 6 feet to Bannerman's bridge. There is a tidal range of about 2 feet at the mouth, which gradually decreases to nothing at Bannerman's bridge. Freshets are liable to occur at any time, although during the summer low-water stages usually prevail.

The commerce for 1901 amounted to 66,873 tons, an increase of 10,125 tons over 1900, and consisted principally of timber, naval stores, general merchandise, building material, fertilizers, cotton, and other farm products. Additional work proposed is for maintenance only.

(*b*) *Black River.*—Distances: From mouth to Point Caswell, 24 miles; Haws Narrows, 34 miles; Clear Run, 64 miles; Lisbon, 86 miles.

The original condition when improvement began was a natural channel cleared fairly to Point Caswell and roughly to Lisbon, with governing low-water depths of 4 feet to Point Caswell, 2.5 feet to Haws Narrows, and 1.5 feet to Lisbon.

The original project of 1885 included clearing the natural channel and banks to Lisbon and the cutting off of a few sharp points at bends; it was amended in May, 1893, by omitting that part of the river above Clear Run, and as amended was completed September 20, 1895.

The existing project, of 1894, is to maintain the natural channel to Clear Run at an estimated cost of $2,000 per annum.

Expenditures.

On original project	$12,358.40
On present project, to June 30, 1902	5,595.67

The result obtained has been a cleared channel whenever funds were available, permitting navigation to Point Caswell at all stages, and to Clear Run at stages of 1.5 feet or higher above low water, the governing low-water depths being 5 feet to Point Caswell, 2.5 feet to Haws Narrows, and 1.5 feet to Clear Run. The low-water stages prevail usually from May to August, inclusive; during the rest of the year the stage is about 5 to 8 feet higher.

The commerce during 1901 amounted to 61,069 tons, an increase of 2,982 tons over 1900, and consisted principally of timber, general merchandise, naval stores, fertilizers, cotton, and other farm products. No further work excepting maintenance is now proposed.

Reference.—For history see Annual Reports of the Chief of Engineers for 1896, page 1125.

(*c*) *Cape Fear River above Wilmington.*—Distances: From Wilmington to Kellys Cove, 47 miles; Elizabethtown, 73 miles; Fayetteville, 115 miles.

The original condition when improvement began was a channel badly obstructed above Kellys Cove by logs, snags, etc., and with governing low-water depths of 4 feet to Kellys Cove and 1 foot to Fayetteville.

The original project of January 26, 1881, was to clear the river to Fayetteville, and obtain a continuous channel by jettying and dredging; estimated in July, 1893, to cost $275,000 for a channel 4 feet deep to Elizabethtown and 3 feet deep to Fayetteville.

The existing project, approved July 11, 1902, is to obtain by canalization a low-water depth of 8 feet to Fayetteville, at an estimated cost of $1,350,000.

Expenditures.

On original project to June 30, 1902:	
For improvement	$134,439.96
For maintenance	8,177.67
	142,617.63

The results obtained have been a cleared channel to Fayetteville, when funds were available, and increased depths above Kellys Cove to 2.5 feet to Elizabethtown and 2 feet to Fayetteville. The tidal range at Wilmington is 2.5 feet, which gradually decreases to nothing at Kellys Cove. Low-water stages prevail from two to four months during each summer, and freshets of 15 feet or higher occur about once a month during the remainder of the year.

The commerce for 1901 amounted to 124,112 tons, a decrease of 5,510 tons since the preceding year, and consisted principally of timber, naval stores, fertilizers, general merchandise, cotton, and other farm products.

The sum of $50,000 was appropriated by the act of June 13, 1902, for the purchase of suitable sites for locks and dams. No expenditures have been made.

NORTHEAST AND BLACK RIVERS, AND CAPE FEAR RIVER ABOVE WILMINGTON.

July 1, 1901, balance unexpended	$394.00
Amount appropriated by river and harbor act approved June 13, 1902	10,000.00
	10,394.00
June 30, 1902, amount expended during fiscal year	53.35
July 1, 1902, balance unexpended	10,340.65
July 1, 1902, outstanding liabilities	21.36
July 1, 1902, balance available	10,319.29

CAPE FEAR ABOVE WILMINGTON.

Amount appropriated by river and harbor act approved June 13, 1902	$50,000.00
July 1, 1902, balance unexpended	50,000.00

(See Appendixes M 11–13.)

12. Cape Fear River, at and below Wilmington, N. C.—In its original condition the governing high-water depth inside the bar was 10 feet, the bar depths at low water being 7.5 feet at the mouth and 8 feet at New Inlet, increased at high water to 12 and 12.5 feet, respectively.

The original project of 1827 was to deepen, by jetties, the channel through the shoals in the 8 miles next below Wilmington. This project resulted in a gain of 2 feet available depth. The project of 1853 was to straighten and deepen the bar channel by dredging, jettying, diverting flow from New Inlet, and closing breaches in Zekes Island. This project was incomplete when the civil war began.

After the civil war the first project was that of 1870, to deepen the bar channel by closing breaches between Smiths and Zekes islands, with the ultimate closure of New Inlet in view. The project of 1873

included that of 1870, and, in addition, the dredging of the bar channel and the closing of New Inlet. The project of 1874 was to obtain, by dredging, a channel 100 feet wide and 12 feet deep at low water up to Wilmington. The project of 1881 was to obtain, by dredging, a channel 270 feet wide and 16 feet deep at low water up to Wilmington. These projects had been practically completed by 1889.

The existing project, of October 6, 1890, is to obtain a low-water depth of 20 feet and a width of 270 feet from Wilmington to the ocean, at an estimated cost of $1,800,000.

Expenditures.

Prior to civil war		$363,228.92
Since civil war on previous projects		2,101,271.93
On existing project to June 30, 1902:		
For improvement	$864,102.27	
For maintenance	58,080.02	
		922,182.29
Total		3,386,683.14

The river channel has been dredged to a least width of 148 feet and least low-water depth of 19 feet, with tidal rise of 4 feet, but subsequent shoaling has decreased the governing depths to 16 feet at low water and 19 feet at high water. The tidal range varies from 4.5 feet at the bar to 2.5 feet at Wilmington.

The commerce for 1901 amounted to 727,359 tons, an increase of 28,003 tons over the preceding year, and consisted principally of cotton, naval stores, manufactured lumber and shingles, fertilizers, building material, coal, and general merchandise. The estimated value was $40,000,000, and it is the largest recorded. The increase from 220,000 tons in 1869 is due to the improvement of the river. The additional work proposed is the completion of the existing project, but the entire appropriation of June 13, 1902, will probably be needed to restore the conditions of three years ago.

References.—For special descriptions see Annual Reports of the Chief of Engineers for 1873, page 44; 1887, page 1047, and 1895, page 1335.

July 1, 1901, balance unexpended	$32,077.47
December 21, 1901, received as rent for dredge Cape Fear	3,255.00
Amount appropriated by river and harbor act approved June 13, 1902	150,000.00
	185,332.47
June 30, 1902, amount expended during fiscal year	23,195.16
July 1, 1902, balance unexpended	162,137.31
July 1, 1902, outstanding liabilities	182.42
July 1, 1902, balance available	161,954.89

(See Appendix M 14.)

13. Town Creek, Brunswick County, N. C.—Distances: From mouth to Russels Landing (upper bridge), 20 miles, to Rocks Landing, 23 miles.

In its original condition this stream was badly obstructed by logs, snags, and overhanging trees and by a shoal just below Russels Landing on which the governing depth was 1.5 feet.

The original project of 1881 was to obtain a 4-foot channel at low water by dredging and clearing along 20 miles from the mouth, at an

estimated cost of $9,078. After expending $1,000 this project was abandoned for lack of appropriations. A second project, of 1899, was to clear the stream of obstructions to Rocks Landing and to obtain a channel depth of 5 feet at low water, with 40 feet width, to Russels Landing, at an estimated cost of $8,500. This project was completed in 1901.

There is no existing project, but when funds are appropriated a project should be adopted for the annual expenditure of about $1,000 for maintenance to Russels Landing.

Expenditures.

On original project	$1,000.00
On project of 1899	8,402.45

The stream has been cleared to Rocks Landing and the channel to Russels Landing deepened to 5 feet at low water for 40 feet width. The tidal range varies from 3 feet at the mouth to a few inches at Russels Landing. The upper part is subject to freshets of 1 or 2 feet rise.

The commerce for 1901 amounted to 9,863 tons, an increase of 717 tons over the preceding year, and consisted of general merchandise, naval stores, lumber, fertilizers, cotton, rice, and other farm products.

July 1, 1901, balance unexpended	$97.55
July 1, 1902, balance unexpended	97.55

(See Appendix M 15.)

14. Removing sunken vessels or craft obstructing or endangering navigation.—An allotment was made from this appropriation March 1, 1902, for removing wreck of the steamer *St. Peter* from the Northeast River, North Carolina, near Hallsville, N. C.

This wreck was removed at a cost of $271.36.

IMPROVEMENT OF WACCAMAW RIVER, NORTH CAROLINA AND SOUTH CAROLINA, AND OF CERTAIN RIVERS AND HARBORS IN SOUTH CAROLINA.

This district was in the charge of Capt. J. C. Sanford, Corps of Engineers, having under his immediate orders Lieut. Edwin R. Stuart, Corps of Engineers, to August 15, 1901. Division Engineer, Col. Peter C. Hains, Corps of Engineers.

1. Waccamaw River, North Carolina and South Carolina, and Little Pedee River, South Carolina.—(*a*) *Waccamaw River.*—In 1880 this stream was navigable for 12-foot boats at all stages of water from Georgetown, 23 miles, to Bull Creek, and at high water 4 miles farther, to Bucks Lower Mills; thence for 7-foot draft boats, at high water, 22 miles farther, to Conway; thence it possessed an obstructed channel for 3-foot draft boats, at ordinary winter water, 68 miles, to Reeves Ferry; thence an obstructed channel, with 3 feet at high water, for 30 miles, to Lake Waccamaw.

The project of improvement, adopted in 1880, provides for a channel 12 feet deep at all stages of water, with 80 feet bottom width from the mouth of the river to Conway, thence a cleared channel to Lake Waccamaw.

The original estimated cost was $29,370, which was revised in 1885 and increased in the annual report of that year to the present figure, $138,400. In the Annual Report of the Chief of Engineers for 1886, page 170, maintenance is estimated at $4,000 per year after completion of improvement.

The total expenditures to June 30, 1902, were $102,624.50. The river had been cleared of snags to a distance of 128 miles above the mouth, and this portion of the river had been frequently resnagged as appropriations permitted, 36,857 snags, etc., having been removed since June 30, 1884. Some work had been done toward increasing the original depth on eight shoals below Conway. As nearly as could be determined from the records, about $75,977.81 had been expended in originally snagging the lower 128 miles of the river and in constructing pile and plank dikes at eight shoals, and $26,646.69 in maintenance.

The available depths reported as now existing do not differ greatly from the original depths. The usual variation in water level is about 7.5 feet at Conway, 50 miles above the mouth, and about 12 feet at Star Bluff, 84 miles above the mouth.

COMMERCIAL STATISTICS.

Year.	Total tons.	Value.	Year.	Total tons.	Value.
1887		$2,129,231.75	1895	128,466	$2,068,697.00
1889		2,308,915.00	1896	203,388	2,314,175.00
1890	67,195	2,317,368.50	1897	241,300	2,406,390.00
1891	76,245	2,231,112.00	1898	258,191	2,666,280.00
1892	83,103	2,178,369.00	1899	376,822	3,135,214.00
1893	70,976	2,095,548.00	1900	467,887	3,481,072.00
1894	99,298	2,120,864.00	1901	302,655	3,835,700.00

The vessels engaged in traffic on this river are steamers and tugboats of from 10 to 300 tons, seagoing schooners of from 300 to 500 tons, pole boats, rafts, etc. One new steamer of 307 tons gross has been put upon the river, running between Georgetown and Hagley, 9 miles above the mouth.

For outline map of the river see page 1200, Annual Report of the Chief of Engineers for 1889. For report on preliminary examination see page 848, Annual Report of the Chief of Engineers for 1880. (Printed as Senate Ex. Doc. No. 117, Forty-sixth Congress, second session.)

This work will hereafter be consolidated, in accordance with river and harbor act approved June 13, 1902, with the improvement of Little Pedee River, and no further separate report made.

(*b*) *Little Pedee River.*—The river in its original condition was much obstructed by snags and overhanging trees and by ten bridges without draws. In places it was divided into several branches, in none of which was there a good channel.

Under the plan of improvement adopted in 1888 it is proposed to snag the river and close unnecessary branches, providing for steamboat navigation up to the mouth of Lumber River, 65 miles, and for pole-boat navigation 48 miles farther, to Little Rock, at an estimated cost of $50,000.

The total expenditures to June 30, 1902, were $21,958.70. No work had been done on the river since June 30, 1898. The river had been well snagged up to the mouth of Lumber River and roughly cleared for pole-boat navigation to Little Rock. No work had been done toward increasing the original depths. As nearly as could be determined from the records, about $19,549.99 had been expended in originally snagging the river and about $2,408.71 in maintenance.

The available depths now existing do not probably differ greatly from the original depths. The usual variation in water level at Gilchrist bridge, about 65.5 miles above the mouth, is about 9.5 feet.

COMMERCIAL STATISTICS.

Year.	Total tons.	Value.	Year.	Total tons.	Value.
1891	4,614	$52,760	1897	13,162	$100,400
1892	7,115	92,964	1898	11,900	105,750
1893	6,153	101,535	1899	16,685	144,787
1894	8,375	114,600	1900	23,780	173,500
1895	12,438	117,470	1901	51,460	399,000
1896	17,050	198,500			

The vessels using the river are one steamer of 89 tons, one small steam launch, pole boats, rafts, etc. No new line of transportation was established during the past year.

For outline map of river see page 1214, Annual Report of the Chief of Engineers for 1890. For preliminary examination and survey see page 1111, Annual Report of the Chief of Engineers for 1887.

July 1, 1901, balance unexpended	$541.04
Amount appropriated by river and harbor act approved June 13, 1902	10,500.00
	11,041.04
June 30, 1902, amount expended during fiscal year	224.24
July 1, 1902, balance unexpended	10,816.80
July 1, 1902, outstanding liabilities	25.80
July 1, 1902, balance available	10,791.00

(See Appendixes N 1 and 2.)

2. Great Pedee River, South Carolina.—The river in its original condition was dangerously obstructed by logs everywhere. Boats drawing 9 feet of water were able to reach Smith Mills, 52 miles above the mouth. Those drawing 3½ feet could get 54 miles farther up at low water to Little Bluff or at high water to Cheraw, 172 miles from the mouth.

The project of improvement adopted in 1880 provides for a thoroughly cleared 9-foot navigation to Smith Mills and a 3½-foot navigation to Cheraw at all stages of water.

The original project contained no estimate of cost. From 1880 to 1886, inclusive, $47,000, was appropriated. In the Annual Report of Chief of Engineers for 1886, page 170, it was estimated that $70,000, in addition to this $47,000 would complete the improvement, and that $5,000 a year would be required for maintenance.

The total expenditures to June 30, 1902, were $111,195.18. The river had been well cleared of snags from the mouth to the Wilmington, Columbia and Augusta Railroad bridge, 103 miles, and less thoroughly snagged between the bridge and Cheraw, 34,946 snags, etc., having been removed since June 30, 1884. No work had been done toward increasing original depths.

As nearly as could be determined by the records, about $78,919.13 had been expended in originally clearing the river of snags and in preliminary examination and survey made in 1900, and about $32,276.05 in maintenance.

The river and harbor act approved June 13, 1902, contains the following item:

Improving Great Pedee River, South Carolina: Continuing improvement, twenty-two thousand five hundred dollars, of which amount twelve thousand dollars shall be expended on the upper portion of said river in accordance with the report submitted in House Document Numbered One hundred and twenty-four, Fifty-sixth Congress, second session: *Provided*, That a contract or contracts may be entered into by the Secretary of War for such materials and work as may be necessary to complete the improvement on said upper portion, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate one hundred and six thousand three hundred dollars, exclusive of the amounts herein and heretofore appropriated.

It is understood to be the intention of Congress, by the above item, to appropriate $5,500 to complete work under the former estimate, $117,000; $5,000 for maintenance; and to adopt the project, with estimated cost of $118,300, referred to in the item. This project provides for obtaining, by snagging and dredging, a cleared channel, with a least depth of 3½ feet at mean low water, from the railroad bridge to Cheraw.

The present available depths are believed to be not far different from those originally existing, though there are a large number of shoals above the bridge on which the depth at low water is less than 3½ feet. The usual variation in water level is 16.4 feet at Smith Mills and 34.2 feet at Cheraw.

COMMERCIAL STATISTICS.

Year.	Total tons.	Value.	Year.	Total tons.	Value.
1891	62,344	$1,367,330	1897	114,177	$1,167,914
1892	92,471	1,401,038	1898	75,280	1,228,886
1893	94,661	1,166,874	1899	134,072	1,692,709
1894	91,025	1,169,070	1900	154,727	2,645,560
1895	106,115	893,430	1901	188,912	2,811,080
1896	229,964	1,325,250			

The vessels engaged in traffic on this river are steamers of 400 tons and less, seagoing schooners, pole boats, rafts, etc. No new line of transportation has been established during the past year.

For preliminary examination and survey see page 845, Annual Report of the Chief of Engineers for 1880 (printed as Senate Ex. Doc. No. 117, Forty-sixth Congress, second session). For outline map of river see page 1180, annual report for 1889. For preliminary examination and survey of 1900, see page 1607, Annual Report of the Chief of Engineers for 1901 (printed in House Doc. No. 124, Fifty-sixth Congress, second session).

July 1, 1901, balance unexpended	$785.64
Amount appropriated by river and harbor act approved June 13, 1902	22,500.00
	23,285.64
June 30, 1902, amount expended during fiscal year	480.82
July 1, 1902, balance unexpended	22,804.82
July 1, 1902, outstanding liabilities	27.20
July 1, 1902, balance available	22,777.62
Amount (estimated) required for completion of existing project	106,300.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	40,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix N 3.)

3. Winyah Bay, South Carolina.—This large bay is connected with the ocean by a passage between the shores of North and South islands 2¼ miles long, 1 mile wide at the bay, ¾ mile wide at the gorge, and 1¼ miles wide at the ocean or southeasterly end of North Island. Through the passage, which trends north-northwest and south-southeast, there was a bold channel 36 feet deep at the bay, retaining a depth of not less than 20 feet until about 3,000 feet southerly from the end of North Island and of not less than 15 feet to a point about 1 mile south of the island, where the channel divided into two. One of these two channels, known as the Main Channel, continued 3¼ miles farther, through extensive shoals, to the 18-foot contour in the ocean. This channel was south-southeast and in alignment with the main channel through the straits. The other, known as Bottle Channel, after flowing about 2,500 feet southeasterly, 1,500 feet easterly, and about 3,000 feet northeasterly, reached the 18-foot contour in the ocean at a distance of about 1¼ miles in a direction from the point of separation from the main ship channel almost at right angles with the direction of that channel and of the channel through the passage. At mean low water the depth on the crest of the bar was variable in both channels and about 7 to 9 feet in the Main Channel and 6 to 8 feet in Bottle Channel. The mean range of tide is 3½ feet.

The present project, adopted in 1889, provides for the construction of two jetties, springing, respectively, from North and South islands and converging toward the bar, the jetties to consist of mattress foundation and a superstructure of large riprap stone raised to a height of 6 feet above mean low water, the south jetty to extend due east across the bar and the north jetty to converge toward it, so as to produce the necessary contraction on the bar. The depth to be secured is 15 feet at mean low water. The river and harbor act approved June 3, 1896, authorized the completion of the work under continuing-contract system, at a cost of not exceeding $1,996,250, in addition to the $20,000 appropriated by the act. A total of $1,698,500 has been appropriated by sundry civil acts since that date.

The total expenditures to June 30, 1902, were $1,735,206.32, of which $428,750 was appropriated prior to June 3, 1896. The following work had been done: On the north jetty the foundation mattress, extending a distance of 11,139 feet from the shore end, had been completed; the stone superstructure, with crest about 6 feet above mean low water, had been carried out to a point 10,947 feet from the shore end, except that for 2,925 feet the portion of this jetty built under former contractors had not yet been raised to full height; a small mound had been built where the jetty changed direction. On the south jetty the foundation mattress, extending to a point 21,051 feet from the shore end, was completed; the stone superstructure, built with practically no top width, had been carried to the proposed outer end; at this end a mound of large stone, with crest about 12 feet above mean low water, had been built; a number of mattresses had been sunk along the northern side of the jetty to prevent undermining, and the crest of the jetty near its shore end had been raised to about 10 feet above mean low water for a length of 1,240 feet. The seagoing suction dredge *Winyah Bay* had been built, and this dredge and the similar dredge *Charleston* had removed 1,026,664 cubic yards of material from the entrance channel and a shoal just within the bay. Spur dikes had been built to protect the South Island beach, and a

mud dike to serve as a root for the south jetty. All jetty work since June 30, 1896, had been done under a continuing contract providing for completing the jetties.

The controlling entrance depth has been increased to 13.9 feet at mean low water, which is on a narrow shoal. Except for this, a depth of 15 feet extends entirely through, though in a narrow and crooked channel, over the Middle Ground Shoal.

COMMERCIAL STATISTICS.

Year.	Total tons.	Value.	Year.	Total tons.	Value.
1891	261,370	$8,071,600	1897	149,374	$5,817,950
1892	271,986		1898	125,003	5,567,880
1893	268,640		1899	120,567	6,337,853
1894	293,822		1900	120,639	6,749,433
1896	171,059	6,228,350	1901	247,989	8,457,906

The vessels using the entrance channel are steamers of 1,850 tons and less, and sailing vessels of various kinds. The freight carried is principally lumber, naval stores, and general merchandise. There are two lines of steamships plying between Georgetown and Northern ports. One of these, the Atlantic Coast Steamship Line, has recently added two chartered steamships of 1,450 and 1,380 tons gross, respectively.

For preliminary examination and survey see annual report for 1885, page 1154. For report of Board of Engineers see Annual Report of the Chief of Engineers for 1889, page 1114 (printed as House Ex. Doc. No. 117, Fiftieth Congress, second session). For reasons for construction of mud dike, see Annual Report of the Chief of Engineers for 1895, page 1351.

July 1, 1901, balance unexpended	$752,561.05
August 2, 1901, credited by auditor's settlement No. 31207	33.76
Amount appropriated by sundry civil act approved June 28, 1902	35,000.00
	787,594.81
June 30, 1902, amount expended during fiscal year	395,517.37
July 1, 1902, balance unexpended	392,077.44
July 1, 1902, outstanding liabilities	83,723.19
July 1, 1902, balance available	308,354.25
July 1, 1902, amount covered by uncompleted contracts	182,091.92
Amount (estimated) required for completion of existing project	317,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	100,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix N 4.)

4. Santee, Wateree, and Congaree rivers, South Carolina.—(*a*) *Santee River.*—This river in its original condition was considerably obstructed at all stages of water by sunken logs and snags. Its bar entrance was narrow, crooked, and shifting, with only about 4 feet of water at low tide, and so situated as to be difficult and expensive to improve.

The original project, adopted in 1880, contemplated providing an outlet for the river into Winyah Bay by constructing a canal from the

river through Mosquito Creek into the bay. On this project there was expended $99,750.

The present project, adopted in 1889, contemplates providing a more satisfactory outlet into the bay by cutting a canal 70 feet wide and 6 feet deep at mean low water from the Estherville plantation to Minim Creek, and for snagging the entire river. The estimated cost is $350,000, not including the amount expended under the original project.

The total expenditures under the present project to June 30, 1902, were $168,000, of which about $12,714.08 was for maintenance. The first cut of the canal had been made entirely through, and this had been widened through a portion of its length. From the Santee River proper 1,025 obstructions had been removed.

Except at the Winyah Bay end, where on account of the softness of the banks the width has been reduced to 40 feet and the depth to 4 feet, the canal is nowhere less than 50 feet wide and 5 feet deep. The mean rise of tide at the canal is about 3½ feet. The least available depth in Santee River is about 5 feet at low water. The usual variation in water level at the Atlantic Coast Line bridge, about 54½ miles above the mouth, is about 19 feet.

COMMERCIAL STATISTICS.

Year.	Total tons.	Value.	Year.	Total tons.	Value.
1891	100,255	$2,743,000	1897	134,206	$2,159,940
1892	110,523	2,775,800	1898	112,205	2,203,800
1893	124,182	2,679,600	1899	154,327	2,679,100
1894	115,428	2,375,000	1900	179,090	2,622,200
1895	117,690	2,224,800	1901	204,375	1,809,000
1896	134,135	2,204,600			

The vessels using the river and canal are steamers of from 10 to 300 tons, small sailing craft, pole boats, rafts, etc. No new line of transportation has been established during the past year, but it is stated that a line of two steamboats will be put on during the present summer.

For report on preliminary examination see page 916, Annual Report of the Chief of Engineers for 1880 (printed as Senate Ex. Doc. No. 161, Forty-sixth Congress, second session).

For full history of work see page 1036, annual report for 1886. For new project and map of river see pages 1184 and 1186, annual report for 1889. For statement showing comparative cost of dredging by contract and by hired labor see pages 1171 and 1172, annual report for 1896, and page 1459, annual report for 1897. For miscellaneous expenses see pages 1458 and 1459, annual report for 1897.

(*b*) *Wateree River.*—In its original condition this stream had a low-water depth of from 3 to 4 feet from its mouth, 67 miles, to Camden. The lower 14 miles was completely blocked at all stages of water by logs, snags, etc., and at moderate stages by the bridges of the South Carolina and the Wilmington, Columbia and Augusta railroads, then without drawspans; thence to Camden navigation was possible, but dangerous except during high water. Its commerce was practically nothing.

The present project of improvement, adopted in 1881, provides for safe and unobstructed 4-foot navigation for steamers from Camden to the mouth, at an estimated cost of $60,000.

The appropriation of September 19, 1890, completed the estimate for the project, but four appropriations have since been made for maintenance. The work is one of snagging only, and as snags are continually lodging, it is not susceptible of completion. Snagging work should be done annually in order to keep the channel open.

The total expenditures to June 30, 1902, were $72,280.59. To June 30, 1900, the river had been kept fairly clear of obstructions from the mouth to Camden. Since June 30, 1884, 24,912 obstructions had been removed, the records prior to that date not giving number removed.

So far as known the available depths now existing do not differ greatly from the original depths. The usual variation in water level is about 17 feet at a point about 4 miles above the mouth, and about 28.5 feet at Camden.

COMMERCIAL STATISTICS.

Year.	Total tons.	Value.	Year.	Total tons.	Value.
1891	1,005	$51,210	1897	43,770	$202,800
1892	2,244	86,040	1898	83,568	274,050
1893	6,242	117,729	1899	109,170	272,200
1894	18,075	94,334	1900	93,024	155,000
1895	21,697	127,565	1901	10,417	50,000
1896	35,002	233,525			

Rafting is the only business done on the river.

For report on preliminary examination see page 914, Annual Report of the Chief of Engineers for 1880 (printed as Senate Ex. Doc. No. 161, Forty-sixth Congress, second session). For survey report and project for improvement see page 1034, Annual Report of the Chief of Engineers for 1881 (printed as House Ex. Doc. No. 61, Forty-sixth Congress, third session). For outline map of river see page 1190, Annual Report of the Chief of Engineers for 1889.

(*c*) *Congaree River.*—In 1886 this stream in its original condition had a low-water depth of 3 to 4 feet from its mouth to the railroad bridge at Columbia; thence 1 foot low-water depth 2 miles farther to its head. The navigation of the lower 47 miles was blocked at all stages of water by the South Carolina Railroad bridge and by sunken logs, snags, and overhanging trees. The navigation of the remaining 2 miles was prevented by swift currents and numerous rock ledges and bowlders. Its commerce was nothing.

The project of improvement, adopted in 1886, proposes to secure a thoroughly cleared 4-foot navigation over the lower 47 miles at all stages of water and a cleared channel 100 feet wide through the ledges and bowlders above, at an estimated cost of $54,500.

The total expenditures to June 30, 1902, were $30,700.82. No work has been done on the river since June 30, 1898. The channel had been thoroughly snagged from the mouth to Granby, 2 miles below Columbia, but no attempt had been made to improve the rapids above Granby. A total of 8,549 obstructions had been removed below Granby. As nearly as can be determined from the records, about $19,523.82 had been expended in originally snagging the river, and about $11,177 in maintenance.

So far as known the available depths now existing do not differ greatly from the original depths. The usual variation in water level at a point 2 miles above the mouth is about 24.3 feet, and at Columbia about 33.2 feet.

COMMERCIAL STATISTICS.

Year.	Total tons.	Value.	Year.	Total tons.	Value.
1891	2,401	$47,840	1897	40,857	$110,100
1892	3,686	62,025	1898	81,362	201,700
1893	2,781	71,125	1899	88,696	191,700
1894	7,974	40,760	1900	121,363	197,000
1895	8,993	45,700	1901	14,583	70,000
1896	18,307	178,900			

Rafting is the only business done on the river.

For preliminary examination and survey see page 1140, Annual Report of the Chief of Engineers for 1885 (printed as House Ex. Doc. No. 254, Forty-eighth Congress, second session). For outline map of river see page 1194, Annual Report of the Chief of Engineers for 1889.

July 1, 1901, balance unexpended	$996.46
Amount appropriated by river and harbor act approved June 13, 1902	27,000.00
	27,996.46
June 30, 1902, amount expended during fiscal year	477.87
July 1. 1902, balance unexpended	27,518.59
July 1, 1902, outstanding liabilities	27.00
July 1, 1902, balance available	27,491.59

(See Appendixes N 5–7.)

5. Congaree River, South Carolina, from Gervais Street Bridge, Columbia, to Granby.—For original condition of this portion of the river see report on Congaree River, South Carolina.

Pursuant to House resolution dated December 15, 1893, a project and estimate were submitted January 2, 1894 (printed in House Ex. Doc. No. 66, Fifty-third Congress, second session), for extending steamboat navigation from Granby to Gervais Street Bridge, Columbia, by the construction of a lock and movable dam near Granby. This document and a letter concerning it are printed on pages 1182–1189, Annual Report of the Chief of Engineers for 1896.

The river and harbor act approved March 3, 1899, appropriated $50,000 for beg nning this work, and authorized continuing contracts to be made for its completion, at a total cost not exceeding $200,000 in addition to the $50,000 appropriated. Three appropriations, aggregating $200,000, have since been made for this work, completing the amount authorized by the act.

The total expenditures to June 30, 1902, were $56,576.88. The necessary land had been acquired, lock keeper's house and other buildings constructed, and a careful survey of the site of lock and dam made. A contract for constructing the lock and dam abutment, except metal work, at a total cost, based on estimated quantities of $77,621, was approved October 20, 1900, the contract time for completion being January 30, 1902; and work under it has since been in progress, though greatly interfered with by an unusual number of freshets, especially in 1901. The contractors had completed the abutment, except the top paving. All rock excavation for the lock had been completed, and about 75 linear feet of each lock wall constructed. Both guide cribs had been completed and most of the earth excavation removed. On account

of delays due to freshets authority was granted January 11, 1902, for a waiver of the time limit for completing this contract, the contractor to be required to complete within a reasonable time and to bear all expenses properly chargeable to him. The lock irons and gate members were purchased under a contract approved August 10, 1901. They had all been delivered, and the gates had been built by hired labor. Plans and specifications for the movable dam had been approved.

There is no navigation at present on this portion of the river. The usual range of water level at Columbia is about 33.2 feet.

July 1, 1901, balance unexpended	$183,742.47
Amount appropriated by sundry civil act approved June 28, 1902	50,000.00
	233,742.47
June 30, 1902, amount expended during fiscal year	40,319.35
July 1, 1902, balance unexpended	193,423.12
July 1, 1902, outstanding liabilities	11,872.69
July 1, 1902, balance available	181,550.43
July 1, 1902, amount covered by uncompleted contracts	48,177.27

(See Appendix N 8.)

6. Inland waterways between Charleston Harbor, South Carolina, and opposite McClellanville.—These waterways consist of a series of creeks, sounds, rivers, and bays, which afford a route sheltered for the most part from the sea by the numerous islands which form the outer coast line. The route is tidal throughout, the range of tide varying from about 4.6 to 5.3 feet. It is now obstructed by a number of shallow reaches and narrow, crooked passages, particularly at points where the tides meet. The passage across Bulls Bay, besides being very shallow, is much exposed. The present commerce is comparatively small, as only very small vessels can get through without excessive delays.

The river and harbor act approved June 13, 1902, contains the following item:

> Improving the inland waterways between Charleston Harbor, South Carolina, and opposite McClellanville, in accordance with the report submitted by the Chief of Engineers, March twenty-sixth, nineteen hundred and two, fifty thousand dollars, the same to be expended at the end of the route from Charleston northward in procuring a channel of four feet depth and sixty feet bottom width: *Provided*, That all land required for the same shall be relinquished free of cost to the Government.

The total estimated cost of improvement to the dimensions stated is $125,290, the work to consist of improving present channels and of avoiding certain crooked and dangerous sections by canals.

A project for carrying into effect the above provision will be submitted as soon as practicable.

For reports on preliminary examinations and surveys of portions of the route see annual report for 1887, page 1114, and annual report for 1890, page 1239 (see House Ex. Doc. No. 82, Fifty-first Congress, first session). For reports on preliminary examination of entire route from Charleston Harbor to Alligator Creek (beyond McClellanville) see Annual Report of the Chief of Engineers for 1900, page 1908 (printed also with map as House Doc. No. 84, Fifty-sixth Congress, first session).

Amount appropriated by river and harber act approved June 13, 1902	$50,000.00
July 1, 1902, balance unexpended	50,000.00

(See Appendix N 9.)

7. Charleston Harbor, South Carolina.—There were originally four channels across the bar, the deepest having about 12 feet depth at low water. Commerce was then using the Pumpkin Hill Channel, about 3 miles south of the present jetty channel. Where the present jetty channel is situated there was then the Swash Channel, with a best depth of 10½ feet of water, too crooked for safe use. The natural channels were shifting in position and variable in depth.

The original project, adopted in 1878, provided for establishing and maintaining, by means of two jetties and auxiliary dredging, a low-water channel of not less than 21 feet depth across the bar. The Swash Channel was selected for improvement. The estimated cost was $3,000,000.

In 1888 it became necessary to modify the height of the crest line of the jetties and to revise the estimate. This increase in the estimate was largely due to the fact that money had been appropriated so slowly that reasonable contract prices could not be obtained. The annual appropriation up to that time had been only 5½ per cent of the original estimate. In the revised project the jetties were increased in height and length, but no change was made in their position or distance apart. The revised estimates were $4,380,500 if the jetties were brought up to low-water level throughout, and $5,334,500 if brought up 3 feet higher. The former estimate was adopted by Congress in the river and harbor act approved July 13, 1892.

The present project, adopted by the river and harbor act approved March 3, 1899, provides for obtaining a channel from Charleston to the ocean not less than 26 feet deep at mean low water (mean range of tide about 5.2 feet) and 600 feet wide, by constructing a large seagoing suction dredge, at a cost of not exceeding $150,000, and operating her, together with the existing dredge *Charleston*, for three years. The estimated cost of constructing the new dredge and operating this dredge as above was $285,000. Of this amount $225,000 has now been appropriated, and $67,257.67 expended. In view of the provisions of the river and harbor act approved June 13, 1902, which make an additional $158,000 available, it will be assumed that $383,000 is the total authorized for this project.

The total expenditures to June 30, 1902, were $4,239,757.67, including about $2,500 expended at Sullivans Island and $10,000 at Mount Pleasant. Of this amount $4,172,500 had been expended on the original project and on maintenance. The jetties had been completed; a 21-foot channel depth at mean low water had been obtained in 1898, and approximately maintained since that date: a channel 24.2 feet deep at mean low water had been dredged through the outer bar on a line to the northward of the original 21-foot channel; a depth of at least 26 feet had been obtained throughout the entrance channel except at the outer bar; the new dredge begun in February, 1901, had been about 70.3 per cent completed, the work on this dredge having been extremely slow.

The river and harbor act approved June 13, 1902, contains the following item:

Improving Charleston Harbor, South Carolina: For maintenance, forty-five thousand dollars: *Provided*, That the unappropriated balance of the amount authorized by the act of July thirteenth, eighteen hundred and ninety-two, to be expended for completing the twenty-one foot project in Charleston Harbor, may be applied to the

operating of dredges under the twenty-six foot project of November eighteenth, eighteen hundred and ninety-eight, as modified and approved by the division engineer.

Under this provision, and in view of the necessity of quickly increasing the entrance depth and width for the use of naval vessels, an estimate of $100,000 for the fiscal year 1904 is submitted for increasing the entrance depth and width, using the two dredges provided and such other dredge or dredges as may at any time be available.

The sundry civil act approved June 28, 1902, provides as follows:

Improving harbor at Charleston, South Carolina: For continuing improvement, fifty thousand dollars.

COMMERCIAL STATISTICS (FOREIGN).

Year.	Total tons.	Value.	Year.	Total tons.	Value.
1889	211,203	$16,744,951	1896	158,325	$11,785,846
1890	224,962	16,041,397	1897	226,750	12,106,763
1891	274,149	23,110,664	1898	214,180	10,956,250
1892	169,379	11,829,607	1899	174,525	6,385,168
1893	193,336	11,940,129	1900	150,631	11,170,910
1894	208,169	11,560,372	1901	141,008	5,276,757
1895	140,938	10,586,326			

The receipts of cotton in 1901 were 246,236 bales, valued at about $10,465,000. All this was shipped out by water; but as much was shipped to domestic ports, or was taken to another domestic port as incomplete cargo, it does not all appear in the commercial statistics above. The receipts in 1900 were 252,984 bales.

The vessels using the entrance channel are steamers, sailing vessels, barges, etc. The steamships of the regular lines number 15. The greatest draft carried through the entrance during the past year was 23.5 feet, which was three times carried by the steamship *Coya*, bringing nitrate of soda. The longest vessel to enter was the steamship *Prinzessin Victoria Louise*, 450 feet in length.

In January, 1902, the Fruit Dispatch Company inaugurated a regular service between Charleston, Cuba, and Costa Rica, 5 steamers constituting the line. This company contemplates establishing another line of 2 steamers between Charleston and Jamaica this summer. Their sailings have numbered about 5 per month, but from now on are expected to average about 8 per month.

The Clyde Steamship Company has added 2 fine steamers, of about 3,400 tons each, to its former number of 8 engaged in the Charleston trade.

For original project see page 553, annual report for 1878. For history of operations to June 30, 1888, see page 970, annual report for 1888. For modified project, including estimates, see page 1150, Annual Report of the Chief of Engineers for 1889. For full history of all operations up to and including the completion of the jetties, with full discussion of the projects and costs, see page 1189, Annual Report of the Chief of Engineers for 1896. For project for securing a depth of 26 feet at low water from the ocean to deep water inside the harbor, see pages 1551–1557, Annual Report of the Chief of Engineers for 1899 (printed as House Doc. No. 83, Fifty-fifth Congress, third session).

July 1, 1901, balance unexpended	$189,757.51
Amount appropriated by river and harbor act approved June 13, 1902	45,000.00
Amount appropriated by sundry civil act approved June 28, 1902	50,000.00
	284,757.51
June 30, 1902, amount expended during fiscal year	82,015.18
July 1, 1902, balance unexpended	202,742.33
July 1, 1902, outstanding liabilities	4,309.97
July 1, 1902, balance available	198,432.36
July 1, 1902, amount covered by uncompleted contracts	96,780.00
Amount (estimated) required for completion of existing project	158,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	100,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix N 10.)

8. Wappoo Cut, South Carolina.—Wappoo Cut in its original condition was a narrow, crooked tidal stream not over 2 feet in depth in some places. It connects Ashley and Stono rivers.

The existing project, adopted in 1881, revised in 1888, provides for straightening, widening, and deepening to secure a fairly direct channel 6 feet deep at mean low water and 60 feet wide. It includes the construction of two training walls at the Stono River entrance, revetting Elliotts Cut, constructing three closing dams, and dredging a cut 200 feet wide and 7 feet deep across the Ashley River bar. The estimated cost of the project was $88,000, including expenditures between 1881 and its date.

The total expenditures to June 30, 1902, were $62,500, of which amount about $3,010.36 was for maintenance. A channel of the projected width and depth had been dug and the banks of Elliotts Cut revetted. Two of the closing dams had been built, and a cut of about 200 feet wide and 7 feet deep had been dredged across the Ashley River bar. A 6-foot channel existed through the canal proper. The cut through the Ashley River bar had narrowed considerably.

The mean range of tide is about 5.5 feet.

COMMERCIAL STATISTICS.

Year.	Total tons.	Value	Year.	Total tons.	Value.
1891	140,000	$1,976,000	1896	271,800	$2,410,000
1892		1,997,500	1899	235,830	2,005,695
1893	142,800	1,865,500	1900	158,849	2,531,899
1894	238,350	1,683,000	1901	177,320	2,732,600
1895	250,230	2,260,100			

The vessels using the cut were steamers of from 40 to 400 tons, sloops, lighters, rafts, etc.

Amount appropriated by river and harbor act approved June 13, 1902	$8,000.00
July 1, 1902, balance unexpended	8,000.00

(See Appendix N 11.)

9. Improving inland waterway between Charleston and Beaufort, S. C.—This waterway consisted originally of a series of creeks,

sounds, rivers, and bays, affording a practicable route for small vessels, being well sheltered from the sea except at the crossing of St. Helena Sound. A 6-foot depth at mean low water existed throughout its length except in Wappoo Cut, Church Flats, Mosquito Creek, and Brickyard Creek (part of Beaufort River). The first and last of these obstructions have been improved to depths of 6 and 7 feet, respectively. At Church Flats the mean low-water depth is about 4 feet, and in Mosquito Creek about 2 feet. The latter is, moreover, extremely narrow and tortuous.

The river and harbor act approved June 13, 1902, contains the following item:

Improving inland waterway between Charleston and Beaufort, South Carolina, with a view to a connection between the South Edisto and Ashepoo rivers at or near Fenwicks Island, in accordance with the report printed on pages nine hundred and ninety-nine et sequentes in the report of the Chief of Engineers for eighteen hundred and eighty-eight, thirty thousand dollars.

The above item contemplates constructing a canal whereby the difficult passage through Mosquito Creek may be avoided. The cost of such a canal, 7 feet deep at mean low water and 90 feet wide at bottom, was estimated in 1888 as $61,600.

The mean range of tide in the proposed canal will be about 7.5 feet.

Commercial statistics for Wappoo Cut are given under that head. Those for Brickyard Creek for the year 1900 are given on pages 1606 and 1607, annual report for 1901.

For report on preliminary examination and survey see page 999, Annual Report of the Chief of Engineers for 1888 (printed as House E Doc. No. 117, Fiftieth Congress, first session).

Amount appropriated by river and harbor act approved June 13, 1902...	$30,000.00
July 1, 1902, balance unexpended	30,000.00

(See Appendix N 12.)

10. Beaufort River, South Carolina.—There was originally a thoroughly good 7-foot channel between the town of Beaufort and Coosaw River, except at a point called Brickyard, near the Coosaw mouth. The least depth here was about 4 feet at low water, and the channel, when deep enough, was too narrow.

The plan of improvement adopted in 1890 was to deepen and widen the channel by dredging to give a continuous, sufficiently wide 7-foot channel at low water all the way through. The estimated cost was $25,000. A layer of rock having been encountered at a higher level than was found by the preliminary borings, the work could not be completed for the amount of the original estimate. On April 15, 1893, the estimate was increased to $40,000.

The total expenditures to June 30, 1902, were $30,592.75. A channel 7 feet deep had been secured all the way through, but it was much too narrow at the point where rock was encountered. Considerable deterioration in depth and width had probably occurred since the last work was done. The mean range of tide is about 7.7 feet.

For report on preliminary examination see page 1235, Annual Report of the Chief of Engineers for 1890 (printed as House Ex. Doc. No. 42, Fifty-first Congress, first session). For reasons for increasing estimate, see page 1529, Annual Report of the Chief of Engineers for 1893.

COMMERCIAL STATISTICS (FOREIGN).

Year.	Total tons.	Value.	Year.	Total tons.	Value.
1888	109,866	$916,038.36	1895	153,760	$4,226,001.32
1889	155,823	1,107,351.00	1896	130,152	4,451,741.62
1890	146,029	1,081,202.00	1897	98,552	2,690,547.07
1891	79,370	765,793.54	1898[a]		
1892	117,124	869,305.49	1899	91,733	434,984.00
1893	141,419	2,270,963.81	1900	46,407	561,457.96
1894	177,310	4,998,471.00	1901	34,192	302,828.60

[a] No report.

The total tons shown for each year is the aggregate tonnage of vessels engaged in foreign commerce as entered and cleared at the customhouse, at Beaufort, S. C.

The values are the aggregate of the foreign exports and imports as given by the collector of customs. None of the coastwise commerce is shown in this statement.

The vessels using the river were steamers of from 40 to 400 tons, schooners, sloops, lighters, rafts, etc.

July 1, 1901, balance unexpended	$411.20
Amount appropriated by river and harbor act approved June 13, 1902	2,000.00
	2,411.20
June 30, 1902, amount expended during fiscal year	3.95
July 1, 1902, balance unexpended	2,407.25

(See Appendix N 13.)

11. Removing sunken vessels or craft obstructing or endangering navigation.—From an allotment of $2,000 made April 26, 1900, for the removal of sunken logs, originally forming parts of rafts, from the "inland passage" between Charleston, S. C., and Beaufort, S. C., there had been expended to June 30, 1902, $519.48 in examining the passage, to determine location and ownership of such obstructions, and in removing those whose ownership could not be determined. The amount expended during the past year is $59.47.

(See Appendix N 14.)

IMPROVEMENT OF RIVERS AND HARBORS IN EASTERN GEORGIA, OF INSIDE WATER ROUTE BETWEEN SAVANNAH, GA., AND FERNANDINA, FLA., AND OF CUMBERLAND SOUND, GEORGIA AND FLORIDA.

This district was in the charge of Capt. Cassius E. Gillette, Corps of Engineers, Division Engineer Col. Peter C. Hains, Corps of Engineers.

1. Savannah Harbor, Georgia.—This covers the estuary of the Savannah River from about 2 miles above the city of Savannah to the ocean bar, about 22 miles below the city. In 1873 the channel was in places not more than 9 feet deep at mean low water.

The original plan of improvement is dated February 11, 1853, and another for removal of obstructions is dated about 1871. A later plan of improvement is dated August 28, 1873, and was supplemented March 19, 1879. It contemplated the establishment of a channel from the city to the sea, practicable at high tide for vessels drawing 22 feet of water. This project was replaced by an enlarged one (January 16,

1882, Annual Report of the Chief of Engineers for 1882, Appendix J 4), contemplating the same channel depth. The amount expended under these projects up to June 30, 1890, was $1,875,061.59.

The project in force up to June 13, 1902, adopted in 1890, providing for a mean high-water depth of 26 feet from the city to the sea, is printed as part of Appendix O, Annual Report of the Chief of Engineers for 1890. The channel depth contemplated by it was reported as having been obtained at the end of the fiscal year 1896. While the project depth was literally obtained the channel was very crooked and of much less than the project width.

A supplemental plan of improvement was submitted December 7, 1894, providing for a detached extension of the Oyster Bed training wall, for the purpose of sheltering the anchorage in Tybee Roads, as well as for protecting the ship channel over the outer part of Tybee Knoll against the destructive action of heavy storms. This project, which is printed as part of Appendix M 1 of the Annual Report of the Chief of Engineers for 1895, was authorized by act of Congress of June 3, 1896, its estimated cost being $992,250. The same act authorized the completion of work for improving the inside route from Savannah, Ga., to Beaufort, S. C., at an additional cost of $106,700, and dredging for maintenance in Savannah Harbor, and the sum of $1,005,000 was appropriated to complete these works.

The amount expended under the project of 1890 up to June 30, 1896, was $3,460,049.99, of which $974,504.88 was for dredging and $2,356,720.10 for contraction work. There had been previously expended $1,875,061.59, giving a total of $5,335,111.58. Between June 30, 1896, and June 30, 1902, $712,918.84 was expended on this project, of which $84,850.98 was for maintenance.

From the time of the reported completion of the project of 1890, in July, 1896, until June 30, 1902, extensive dredging has been done, both as maintenance and as part of the modification of the project. The project depth has generally been maintained; the controlling depth on June 30, 1902, being 18 feet, at mean low water, on the shoal at Venus Point, where the mean rise of tide is 6.8 feet.

During the past fiscal year dredging has been carried on for maintenance, there having been dredged 198,380.9 cubic yards.

In 1872 the tonnage of vessels arriving and clearing at Savannah Harbor was somewhat more than 1,000,000; the total value of imports and exports about $34,000,000. Cotton, lumber, wool, hides, naval stores, and rice were principally dealt in. In 1890 the total tonnage was reported to have increased to about 2,000,000 and the value of imports and exports to $152,000,000. Besides the articles named above, fruit, produce, and iron were handled extensively.

For the calendar year 1901 the total tonnage was 2,843,261, valued at about $158,495,188.

A project of improvement calling for a depth of 28 feet, at mean high water, from above the city to the ocean, at an estimated cost of $1,567,791, was adopted by act of Congress approved June 13, 1902. No expenditure under this project has been made.

The various projects of improvement will be found printed in the following documents:

Senate Ex. Doc. No. 1, Thirty-third Congress, first session, and Annual Report of Chief of Engineers for 1853, page 468.

Project for removal of Confederate obstructions, Annual Report of Chief of Engineers for 1872, page 653.

Project for 22 feet depth at high water, Annual Report of Chief of Engineers for 1873, page 736, and modifications in the following reports: For 1875, Part II, page 34; for 1876, Part I, page 437; for 1880, Part I, page 933 and for 1882, Part II, page 1152.

Project for 26 feet depth at high water, Annual Report of Chief of Engineers for 1890, Part II, page 1258, and modifications as follows: House Ex. Doc. No. 115, Fifty-third Congress, third session; Annual Report of Chief of Engineers for 1895, Part II, page 1459, and Annual Report of Chief of Engineers for 1900, Part III, page 1922.

Project for 28 feet depth at high water, House Ex. Doc. No. 57, Fiftieth Congress, first session, and Annual Report of Chief of Engineers, Part II, page 1057, for 1888; modifications in House Doc. No. 123, Fifty-sixth Congress, second session; and Annual Report of Chief of Engineers for 1901, page 1719.

A detailed history of the work of improvement may be obtained by consulting Annual Report of Chief of Engineers for 1888, Part II, page 1013, and report for 1896, Part II, page 1218.

Maps showing the condition of the works at various dates may be found in the following documents:

Annual Report of Chief of Engineers for 1880, Part I, page 933.
Annual Report of Chief of Engineers for 1885, Part II, page 1202.
Annual Report of Chief of Engineers for 1888, Part II, page 1072.
Annual Report of Chief of Engineers for 1891, Part II, page 1496.
Annual Report of Chief of Engineers for 1896, Part II, page 1245.
House Ex. Doc. No. 57, Fiftieth Congress, first session (1888).
House Ex. Doc. No. 115, Fifty-third Congress, third session (1895).

July 1, 1901, balance unexpended	$439,708.94
Amount appropriated by river and harbor act approved June 13, 1902.	50,000.00
	489,708.94
June 30, 1902, amount expended during fiscal year	52,841.31
July 1, 1902, balance unexpended	436,867.63
July 1, 1902, outstanding liabilities	13,728.17
July 1, 1902, balance available	423,139.46
July 1, 1902, amount covered by uncompleted contracts	14,242.38
Amount (estimated) required for completion of existing project	1,000,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	500,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix O 1.)

2. Savannah River, Georgia, below Augusta.—Previous to improvement there were numerous shoals in the river with less than 3 feet at summer low water, the other obstructions consisting of overhanging trees, snags, and sunken logs. The aggregate length of river upon which there was less than 5 feet was about 9,800 feet, divided up into 10 shoals, and the controlling depth was about 2½ feet.

The original project, submitted December 22, 1880, provided for a 5-foot channel, 80 feet wide, by means of removal of snags, trees, sand bars, etc., and protection of banks at a cost of $91,000.

Under this project there was expended prior to operations under the existing project $93,480.09.

The existing project, adopted in 1890, provides for the establishment of a navigable steamboat channel 5 feet deep at ordinary summer low water between the cities of Augusta and Savannah, to be accomplished by removing sand and gravel bars, regulating portions of the river, revetting caving banks, closing incipient cut-offs, and removing snags and logs from the channel and overhanging trees from the banks of the stream.

The total estimated cost of this improvement, in round numbers, is $332,000, on the supposition that funds are regularly and adequately supplied, besides $3,000 to $5,000 annually for maintenance.

The amount expended upon the work under the existing project up to the close of the fiscal year ending June 30, 1902, was $228,572.99, which, added to the amount previously expended, gives a total expenditure for this work of $322,053.08.

The results of the work under the present project are as follows: The aggregate length of shoal water with less than 5 feet has been reduced to about 1,800 feet. A great many of the snags have been removed and great numbers of overhanging trees cut on the banks. The controlling depth at present is 3.4 feet at ordinary summer low water. The river occasionally falls perhaps a foot below this and rises more than 30 feet in time of floods, frequently standing for long periods at several feet above summer low water.

Prior to the improvement the commerce was small, but its quantity unknown. At times since, previous to the construction of railroads, it has probably been greater than it is now, as since the advent of railroads the river has never been in a good navigable condition until recently. The commodities carried consist principally of cotton, naval stores, fertilizers, and general merchandise. Excluding timber, the tonnage for the year 1901 amounted to 54,600 tons, valued at $3,520,000, besides 114,411 bushels of rice, valued at $114,411, received at Savannah in small boats. There was also rafted down the river during 1901 about 12,000,000 feet B. M. of timber, valued at about $156,000.

The various projects of improvement will be found printed in the following documents:

Original project, Annual Report of Chief of Engineers for 1881, Part II, page 1088, and House Ex. Doc. No. 23, Forty-sixth Congress, third session.

Modifications of original project, Annual Report of Chief of Engineers for 1886, Part II, page 1098, and report for 1887, Part II, page 1166.

Present project, Annual Report of Chief of Engineers for 1890, Part II, page 1324, and House Ex. Doc. No. 255, Fifty-first Congress, second session.

A detailed history of the work of improvement may be obtained by consulting annual reports of the Chief of Engineers, as follows:

Report of 1888, Part II, page 1029.

Report of 1890, Part II, page 1324.

Report of 1899, Part II, page 1569.

Maps showing the condition of the work at various dates may be found in the following documents:

House Ex. Doc. No. 23, Forty-sixth Congress, third session.

Annual Report of Chief of Engineers for 1883, Part I, page 908.

Annual Report of Chief of Engineers for 1884, Part II, page 1106.
Annual Report of Chief of Engineers for 1885, Part II, page 1210.
Annual Report of Chief of Engineers for 1886, Part II, page 1094.
House Ex. Doc. No. 255, Fifty-first Congress, second session.

July 1, 1901, balance unexpended	$146,082.52
Amount appropriated by sundry civil act approved June 28, 1902	86,000.00
	232,082.52
June 30, 1902, amount expended during fiscal year	100,635.60
July 1, 1902, balance unexpended	131,446.92
July 1, 1902, outstanding liabilities	16,194.03
July 1, 1902, balance available	115,252.89
July 1, 1902, amount covered by uncompleted contracts	29,252.89

(See Appendix O 2.)

3. Savannah River, above Augusta, Ga.—In its original condition the river, at low water, was navigable only with great difficulty on account of shallow water, obstructing logs, etc.

The original project of improvement, submitted February 8, 1879, provided for a 3-foot channel, 30 feet wide, from Augusta, Ga., to Trotters Shoals, and the removal of snags, trees, etc., to the Tugaloo River, at a cost of $45,000.

Under this project there was expended, prior to operations under the existing project, $39,000.

The existing plan of improvement, adopted by Congress July 13, 1892, provides for the establishment, between Petersburg and the Locks, of a downstream channel 12 to 25 feet in width and navigable during ordinary summer low water for pole boats drawing 2 feet, and of an upstream channel navigable for pole boats drawing 1.3 feet of water. This is to be obtained by removing logs and overhanging trees; excavating rock, sand, or gravel, and with excavated materials raising crests of ledges; constructing training walls to increase flow of water through sluices. The total estimated cost is $33,000.

The total amount expended under the present project up to June 30, 1902, was $19,935.55, which, added to that previously expended, gives a total for this work of $58,935.55.

The work accomplished under this project has given a downstream channel about 2 feet deep and an upstream channel of the project depth. In many places, however, these channels are difficult to navigate and are capable of greater improvement.

In 1876–77 about 2,000 tons of freight went upstream from Augusta, and about 12,000 bales of cotton came down. In 1888 the down-going freight was estimated at about 5,000 bales of cotton, and in 1901 the total freight carried on the river, excluding timber, amounted to 2,120 tons, valued at $146,450.

The various projects of improvement will be found printed in the following documents:

Original project, Annual Report of Chief of Engineers for 1879, Part I, page 747.

Present project, Annual Report of Chief of Engineers for 1890, Part II, page 1366, and House Ex. Doc. No. 213, Fifty-first Congress, first session.

A detailed history of the work of improvement may be obtained by

consulting the Annual Reports of the Chief of Engineers for 1888, Part II, page 1032, and for 1900, Part III, page 1930.

Maps may be found in the following documents:

Annual Report of Chief of Engineers for 1886, Part II, page 1094.

House Ex. Doc. No. 213, Fifty-first Congress, first session.

July 1, 1901, balance unexpended	$64.45
July 1, 1902, balance unexpended	64.45

(See Appendix O 3.)

4. Harbor at Darien, and Doboy Bar, Georgia.—(*a*) *Darien Harbor.*—In its original condition this harbor was obstructed at seven points by shoals with mean low-water depths of from 6½ to 10½ feet. Between the shoals there was nowhere less than 12 feet at mean low water.

There was expended on this harbor in 1879 for dredging, $8,000, without any project having been recommended or adopted.

The project for the improvement of this harbor, adopted in 1885, contemplates the establishment of a navigable channel 12 feet deep at mean low water between Darien and Doboy, at an estimated cost of $170,000. Work was not begun under this project until 1891. The total amount expended under it up to June 30, 1902, was $104,989.54, which, added to the amount previously expended, gives a total for this work of $112,989.54. As a result there is at present a low-water depth of about 12 feet on all of the shoals mentioned, except the one in Old River, on which there is only 6 feet. Boats drawing 12 feet can, however, reach all the wharves at Darien, at mean low water, except through the channel to the Lower Ridge Mill. The mean rise and fall of the tide is about 6½ feet.

The total tonnage for 1878 was estimated at about 200,000, and the value of the exports at between $600,000 and $700,000. In 1901 the total annual trade, consisting almost entirely of timber, was estimated at 118,834 tons, valued at $781,080.

By act of Congress approved June 13, 1902, this work was consolidated with Doboy Bar, Georgia.

The present project will be found in the Annual Report of the Chief of Engineers for 1885, Part II, page 1238.

A detailed history of the work of improvement may be obtained by consulting the Annual Reports of the Chief of Engineers for 1895, Part II, page 1473, and of 1896, Part II, page 1253.

A map showing the jetties constructed will be found in the Annual Report of the Chief of Engineers for 1895, Part II, page 1477.

(*b*) *Doboy Bar.*—In 1888, $5,795.40 was spent in harrowing and water-jet work on this bar without result. In its original condition there was about 12 feet at mean low water in the old channel, which was very crooked, so that the entrance was not much used.

The project for its improvement, adopted by act of Congress of March 3, 1899, provides for creating a channel by dredging 24 feet deep at mean high water and 300 feet wide, estimated to cost $70,000. The proposed channel is some distance north of the old channel.

The amount expended under the project up to June 30, 1902, was $19,134.04, which, added to the amount previously expended, gives a total expenditure for this work of $24,929.44.

By the act of Congress approved June 13, 1902, this work was consolidated with Darien Harbor.

During the years 1899–1900 about 120,000 cubic yards of material

was removed. The contractor abandoned the work December 16, 1900, since which date nothing has been done, bids having been advertised to be opened March 21, 1902, but none were received.

This bar is in a transition stage, and the best line for dredging can be determined better after more settled natural conditions obtain. The latest reports indicate that the controlling depth on the bar in a practicable channel is 11 feet at mean low water. This is in the old channel, there being about 10 feet in the proposed channel. The tide rises 7.3 feet.

The commerce interested in this bar consists of lumber from the Altamaha River, the bulk of which is now shipped from Sapelo Sound and St. Simon Sound, north and south, respectively, of Doboy Bar. During the calendar year 1901, 12,503,910 feet B. M. of lumber, valued at $100,031, crossed the bar.

The projects of improvement will be found printed in the following documents:

Original project, Annual Report of Chief of Engineers for 1887, Part II, page 1179.

Present project, Annual Report of Chief of Engineers for 1897, Part II, page 1539, and House Doc. No. 13, Fifty-fifth Congress, first session.

A detailed history of the work of improvement may be obtained by consulting the annual reports of the Chief of Engineers, as follows:

Report of 1887, Part II, pages 1179 and 1199.
Report of 1888, Part II, page 1041.
Report of 1899, Part II, page 1573.
Report of 1901, Part II, page 1639.

Maps may be found in the following documents:

Annual Report of Chief of Engineers for 1888, Part II, page 1042.
House Doc. No. 13, Fifty-fifth Congress, first session.
Annual Report of Chief of Engineers for 1899, Part II, page 1573.

July 1, 1901, balance unexpended	$51,301.90
Amount appropriated by river and harbor act approved June 13, 1902	30,000.00
	81,301.90
June 30, 1902, amount expended during fiscal year	425.48
July 1, 1902, balance unexpended	80,876.42

(See Appendixes O 4 and 5.)

5. Altamaha River, Georgia.—Before improvement the Altamaha River was obstructed by rock ledges, sand bars, snags, sunken logs, and overhanging trees. The low-water depths at some points did not exceed 1 foot.

The original project of improvement, submitted in 1875, contemplated a channel 4 feet deep and 80 feet wide from Macon to Darien, by the removal of sand bars, rock, shoals, snags, overhanging trees, etc., at a cost of $162,000.

Under it and its modifications there was expended up to June 30, 1890, $69,776.59.

The existing project of improvement, adopted by Congress in 1890, provides for the establishment of a channel 3 feet deep at summer low water throughout the river above Darien. This is to be accomplished by removing rock, shoals, and sand bars, building deflecting dikes and closing incipient cut-offs, removing snags and sunken logs from the

channel and overhanging trees from the banks of the stream and revetting caving banks. The total estimated cost of the improvement is $129,000, provided funds are regularly and adequately supplied, besides from $3,000 to $5,000 for annual maintenance.

The amount expended on the work, under the present project, up to June 30, 1902, was $65,005.10, which, added to the amount previously expended, gives a total expenditure for this work of $134,781.69.

This expenditure has resulted in the removal of one rock shoal, three sand bars, numerous snags, sunken logs, and overhanging trees. The greatest draft that can at present be carried at summer low water is about 2 feet by waiting for the tide at Coupers Bar.

The commerce of the river, before the improvement was begun, was reported to have amounted to about 100,000 tons annually, valued at about $1,000,000. During the calendar year 1901 it is estimated to have amounted to about 15,000 tons, valued at about $1,025,000. There was also rafted down the river 114,109,000 feet B. M. of timber, valued at $1,428,000.

The various projects of improvement will be found printed in the following documents:

Original project, Annual Report of Chief of Engineers, 1875, Part II, page 670.

Modifications of original project, Annual Report of Chief of Engineers for 1881, Part II, page 1107, and Annual Report of Chief of Engineers for 1887, Part II, page 1176.

Present project, Annual Report of Chief of Engineers for 1890, Part II, page 1372, and House Ex. Doc. No. 283, Fifty-first Congress, second session.

A detailed history of the work of improvement may be obtained by consulting the Annual Reports of the Chief of Engineers, as follows:

Report of 1888, Part II, page 1038.
Report of 1889, Part II, page 1246.
Report of 1892, Part II, page 1261.
Report of 1900, Part III, page 1939.

Maps may be found in the following documents:

Annual Report of Chief of Engineers, 1884, Part II, page 1116.
House Ex. Doc. No. 283, Fifty-first Congress, second session.

July 1, 1901, balance unexpended	$1,873.07
Amount appropriated by river and harbor act approved June 13, 1902	10,000.00
	11,873.07
June 30, 1902, amount expended during fiscal year	1,654.76
July 1, 1902, balance unexpended	10,218.31

(See Appendix O 6.)

6. Ocmee River, Georgia.—In its original condition this river was used principally for navigation at high stages. At low water there were numerous shoals and snags, there probably being less than 2 feet on many sand bars and rock ledges.

The original project was submitted January 29, 1875, and provided for the removal of snags, overhanging trees, etc., cutting off points, and making cut-offs, at a cost of $10,150.

Under this project and its modifications there was expended, previous to the commencement of operations under the existing project, the sum of $44,822.18.

The existing project of improvement was adopted by Congress September 19, 1890. It provides for the establishment of a navigable channel 3 feet deep at ordinary summer low water from Milledgeville to the mouth. This is to be accomplished by removing rock shoals and sand bars, revetting caving banks, and closing incipient cut-offs, removing snags and logs from the channel and overhanging trees from the banks of the stream. The cost of the improvement is estimated at $171,000, besides from $3,000 to $5,000 for annual maintenance.

The amount expended under the present project up to June 30, 1902, was $83,834.55, which, added to the amount previously expended, gives a total expenditure for this work of $128,656.73.

As a result of this expenditure numerous snags and logs, bowlders, and overhanging trees have been removed, several cut-offs opened and others closed, and two training dikes built, but the total improvement has been small, as the river is now full of snags and is obstructed with overhanging trees. The controlling depth at ordinary summer low water is probably about 2 feet. The river occasionally falls below this stage and frequently rises to considerable heights above it.

No reliable statistics of the commerce of the river before the improvement was begun are available. In 1901 the amount of freight carried on the river amounted to 32,000 tons, valued at $480,000. Besides this, 55,704,500 feet B. M. of timber, valued at about $684,870, was rafted down the river.

The various projects of improvement will be found in the following documents:

Original project: Annual Report of Chief of Engineers for 1875, Part II, page 41.

Present project: Annual Report of Chief of Engineers for 1890, Part II, page 1432, and House Ex. Doc. No. 211, Fifty-first Congress, first session.

A detailed history of the work of improvement may be obtained by consulting Annual Reports of the Chief of Engineers for 1889, Part II, page 1253, and for 1900, Part II, page 1942.

Maps of the river will be found in House Ex. Doc. No. 211, Fifty-first Congress, first session.

July 1, 1901, balance unexpended	$662.42
Amount allotted from emergency act approved June 6, 1900	650.00
Amount appropriated by river and harbor act approved June 13, 1902	25,000.00
	26,312.42
June 30, 1902, amount expended during fiscal year	1,219.15
July 1, 1902, balance unexpended	25,093.27

(See Appendix O 7.)

7. *Ocmulgee River, Georgia.*—In its original condition this river was used for navigation chiefly at high stages. At low water there were numerous shoals and snags, there probably being less than two feet on many sand bars and rock ledges.

The original project was submitted in 1875, and provided for a channel 80 feet wide and 4 feet deep at low water, to be accomplished by the removal of sand bars, rock shoals, snags, overhanging trees, etc., from Macon to Darien, at a cost of $162,000.

The amount expended under this project and its modifications prior to operations under the existing project was $79,390.73.

The existing project of improvement, adopted by Congress September 19, 1890, provides for the establishment of a navigable channel 3 feet deep at ordinary summer low water from Macon to the river's mouth. This is to be obtained by removing rock shoals, sand bars, closing incipient cut-offs and revetting caving banks, removing snags and logs from the channel, and overhanging trees from the banks of the stream.

The cost of the improvement as given in the project of 1890 is estimated at $210,000, provided funds are regularly and adequately provided, besides from $3,000 to $5,000 for annual maintenance.

The amount expended under the present project up to June 30, 1902, was $175,098.54, which, added to the amount previously expended, gives a total expenditure for this work of $254,489.27.

The work under the present project has resulted in marked improvement. Below Hawkinsville the navigable depth has practically been obtained throughout the river; Buttermilk Shoal, the worst of a series of rock shoals above that point, has been totally removed, and Town Shoal, in the same vicinity, has been about half removed. At a series of sand bars just below Macon training dikes have been constructed, which produced the project depth throughout this portion of the river, but an unusually destructive flood in the month of March, 1902, tore up the banks for long stretches both above and below Macon, broke around the head of one of the training dikes, and filled the channel below with sand. This will be removed in a few days.

No reliable statistics of the commerce of the river before the improvement was begun are available. In 1901 the amount of freight carried on the river amounted to 15,000 tons, valued at about $1,000,000. Besides this, 40,500,000 feet B. M. of timber, valued at about $525,000, was rafted down the river.

The various projects of improvement will be found printed in the following documents:

Original project: Annual Report of Chief of Engineers for 1875, Part II, page 670.

Modifications of original project: Annual Reports of the Chief of Engineers for 1882, Part II, page 1859; for 1885, Part II, page 1297; for 1886, Part II, page 1160, and for 1887, Part II, page 1276.

Present project: Annual Report of the Chief of Engineers for 1890, Part II, page 1458, and House Ex. Doc. No. 215, Fifty-first Congress, first session.

A detailed history of the work of improvement may be obtained by consulting the Annual Reports of the Chief of Engineers for 1889, Part II, page 1258, and for 1900, Part II, page 1944.

Maps of the river will be found in House Ex. Doc. No. 215, Fifty-first Congress, first session.

July 1, 1901, balance unexpended	$47,228.07
Amount appropriated by sundry civil act approved June 28, 1902	56,000.00
	103,228.07
June 30, 1902, amount expended during fiscal year	47,217.34
July 1, 1902, balance unexpended	56,010.73
July 1, 1902, outstanding liabilities	10.73
July 1, 1902, balance available	56,000.00

(See Appendix O 8.)

8. Brunswick Harbor, Georgia.—Previous to June 13, 1902, the projects under this title have been for the inner harbor only, consisting principally of the removal of a shoal in East River, opposite the lower part of the city.

The original project of improvement, dated April 29, 1876, provided for the construction of a jetty at the city front and dredging at a total cost of $69,000.

Under this project and its modifications there was expended prior to operations under the existing project the sum of $190,000.

The project in force up to June 13, 1902, was adopted by Congress in 1894. It provided for the maintenance of a navigable channel 15 feet deep at mean low water, by keeping the existing works in repair and by dredging. The act of June 3, 1896, provided for the improvement of Academy Creek. The cost of maintaining a channel depth of 15 feet at mean low water was estimated at $15,000 per annum.

There has been expended under this project up to June 30, 1902, $34,817.25, all of which has been for maintenance.

Including $10,000 spent in 1836 for dredging, the total amount expended up to June 30, 1902, on the inner harbor was $234,817.25.

At present the controlling depth on the shoal in East River is 16 feet at mean low water; the rise of the tide is 6.6 feet. The channel is not self-maintaining.

The act of Congress approved June 13, 1902, provides for dredging on the outer bar to a depth of 19.3 feet at mean low water (26 feet at mean high water), at an estimated cost of $40,000. It also provides for dredging in Academy Creek.

Before the improvement in 1880 the annual tonnage of the port of Brunswick was about 100,000, consisting chiefly of lumber, naval stores, wood, rice, and merchandise, valued at about $1,700,000. In 1901 the total tonnage of the port amounted to 677,256 tons, valued at $28,091,111.

The various projects of improvement will be found printed in the following documents:

First plan: Annual Report of Chief of Engineers for 1876, Part I, page 489.

First project: Annual Report of Chief of Engineers for 1880, Part I, page 962.

First revision of project: Annual Report of Chief of Enginners for 1886, Part II, page 1113, and report for 1887, Part II, page 1184.

Second revision of project: Annual Report of Chief of Engineers for 1895, Part II, page 1494.

Third revision of project: House Doc. No. 40, Fifty-sixth Congress, first session.

Project for bar: Annual Report of Chief of Engineers for 1892, Part II, page 1327, and House Ex. Doc. No. 34, Fifty-second Congress, first session.

Revised project for bar: House Doc. No. 179, Fifty-sixth Congress, second session; House Doc. No. 355, Fifty-sixth Congress, second session, and Annual Report of Chief of Engineers for 1901, Part II, page 1663.

A detailed history of the work of improvement may be obtained by consulting the annual reports of the Chief of Engineers for 1888, Part II, page 1047; for 1889, Part II, page 1258; for 1890, Part II, page 1407.

Maps showing the condition of the work at various dates may be found by consulting the following documents:

Annual Report of Chief of Engineers for 1880, Part I, page 962.
Annual Report of Chief of Engineers for 1881, Part II, page 1116.
Annual Report of Chief of Engineers for 1883, Part I, page 922.
Annual Report of Chief of Engineers for 1885, Part II, page 1228.
Annual Report of Chief of Engineers for 1886, Part II, page 1116.
Annual Report of Chief of Engineers for 1887, Part II, page 1196.
Annual Report of Chief of Engineers for 1889, Part II, page 1266.
Annual Report of Chief of Engineers for 1892, Atlas, page 58.
Annual Report of Chief of Engineers for 1893, Part II, page 1583.
House Ex. Doc. No. 34, Fifty-second Congress, first session, and House Docs. Nos. 40, Fifty-sixth Congress, first session, and 355, Fifty-sixth Congress, first session.

July 1, 1901, balance unexpended	$247.06
Amount appropriated by river and harbor act approved June 13, 1902	165,000.00
	165,247.06
June 30, 1902, amount expended during fiscal year	64.31
July 1, 1902, balance unexpended	165,182.75

(See Appendix O 9.)

9. Inside water route between Savannah, Ga., and Fernandina, Fla.—This route consists of a series of bays and tidal sloughs, making a connecting waterway, not exposed to rough water except at a few points in stormy weather. The waters forming the route are shown on Coast Survey charts Nos. 156 and 157.

The project of improvement was adopted in 1892 and provides for the establishment of a channel 7 feet deep at mean low water. This is to be accomplished by the improvement of Romerly Marsh, Mud River, Little Mud River, and Jekyl Creek. The estimated cost of the improvement is $105,000, provided the entire sum be made available at one time.

The total amount expended under this project up to June 30, 1902, was $48,915.66, which, together with the amount expended for Jekyl Creek and Romerly Marsh, $71,108.77, makes a total of $120,024.43.

At present the controlling depths are as follows, beginning at the southern end: The Dividings, 5 feet; Jekyl Creek, 6 feet; Mud River, 4 feet; Romerly Marsh, 4 feet, at mean low water.

The value of the commerce passing through this route was estimated in 1890 at between $200,000 and $400,000 per annum. For 1901 it amounted to about 42,176 tons of freight, valued at about $2,614,955, and 163,362,478 feet B. M. of timber, valued at $1,668,164. None of this commerce passed over the whole extent of the route.

The present project will be found in the Annual Report of the Chief of Engineers for 1892, Part II, page 1309, and in House Ex. Doc. No. 41, Fifty-second Congress, first session.

A detailed history of the work of improvement will be obtained by consulting the Annual Reports of the Chief of Engineers, as follows:

Report of 1892, Part II, page 1309.
Report of 1893, Part II, page 1206.
Report of 1901, Part II, page 1653.

A map of the route will be found in House Ex. Doc. No. 41, Fifty-second Congress, first session.

July 1, 1901, balance unexpended	$132.59
Amount appropriated by river and harbor act approved June 13, 1902	15,000.00
	15,132.59
June 30, 1902, amount expended during fiscal year	48.25
July 1, 1902, balance unexpended	15,084.34

(See Appendix O 10.)

10. Cumberland Sound, Georgia and Florida.—In its original condition the available depth at the entrance varied from 11 to 12.5 feet at mean low water. The point of crossing the bar was subject to very great changes in location, moving in a series of years as much as 1½ miles.

The project of improvement submitted in 1879 and revised by a Board of Engineers in 1891 provides for the construction of two low jetties from the shores on opposite sides of the entrance and extending seaward across the bar, upon lines so directed that the ends will be parallel to each other and about 3,900 feet apart. These jetties were intended to establish a low-water channel across the bar not less than 19 feet in depth. The cost of the improvement was originally estimated at $2,071,023, and as modified at $1,606,500, for the completion of low jetties, and at $2,079,500 if high jetties were found necessary. There has been expended under this project $932,500.

The present project, which was adopted by act of Congress of June 3, 1896, provides for the establishment of a channel across the bar 19 feet deep at mean low water by the construction of two jetties of stone, resting on a foundation of brush mattresses, on the same lines as those in the previous project, the scour between the jetties to be aided by dredging, if necessary. The total cost of the improvement, at the time of this project, to be $2,350,000, exclusive of amounts previously appropriated.

The amount expended under this project up to June 30, 1902, was $1,208,931.33, which, added to the amount previously expended, gives a total expenditure for this work of $2,141,431.33.

Previous to November 1, 1900, the progress of the work on this bar was very slow and the channel, up to within a few months, has been of late years across the line of the south jetty. The present work is being carried on on the original lines laid down by General Gillmore in 1879, and the work at present is in a very satisfactory condition. The old channel across the line of the south jetty has been abandoned and the closing of the gap in the jetty will present no unusual difficulties. A good straight channel exists parallel to the north jetty and in the most favorable location, with a controlling depth on the bar on June 30, 1902, of 20 feet at mean low water, with 19 feet inside on an interior shoal. The mean rise of the tide is 7 feet. A small amount of dredging has been done in this channel during the past few months while shipping was changing from the old to the new channel.

Before improvement (in 1879) the annual in and out bound tonnage at Fernandina was about 300,000, and the value of imports and exports about $2,500,000, lumber, naval stores, and cotton being the principal articles. In 1901 the total tonnage of the port amounted to 479,337 tons, valued at $15,212,339.

The project for this improvement will be found in the Annual Report of the Chief of Engineers for 1879, page 792, and the modi-

fications in the Annual Report of the Chief of Engineers for 1891, Part II, page 1566, and report for 1896, Part II, page 1289.

A detailed history of the work of improvement may be obtained by consulting the following documents:

Annual Report of Chief of Engineers for 1876, Part I, page 459.
Annual Report of Chief of Engineers for 1878, Part I, page 580.
Annual Report of Chief of Engineers for 1883, Part I, page 934.
Annual Report of Chief of Engineers for 1885, Part II, page 1232.
Annual Report of Chief of Engineers for 1888, Part II, page 1054.
Annual Report of Chief of Engineers for 1893, Part II, page 1599.
Annual Report of Chief of Engineers for 1897, Part II, page 1533.
Senate Ex. Doc. No. 19, Fifty-second Congress, second session.
Senate Doc. No. 163, Fifty-fifth Congress, first session.

Maps showing the condition of the work at various dates may be found in the following documents:

Annual Report of Chief of Engineers for 1876, Part I, page 482.
Annual Report of Chief of Engineers for 1888, Part II, page 1052.
Annual Report of Chief of Engineers for 1889, Part II, page 1276.
Annual Report of Chief of Engineers for 1891, Part II, page 1561.
Annual Report of Chief of Engineers for 1892, Atlas, page 60.
Annual Report of Chief of Engineers for 1893, Part II, page 1596.
Annual Report of Chief of Engineers for 1898, Part II, page 1326.
Annual Report of Chief of Engineers for 1899, Part II, page 1597.
Senate Doc. No. 163, Fifty-fifth Congress, first session.

The dredge designed for this work is being built under the direction of Capt. J. C. Sanford, Corps of Engineers, and contracts are now in force for its construction. At the close of the past fiscal year the contract for hull and propelling machinery was about 59.6 per cent completed, the hull being nearly ready for launching; the pumps and pumping engines had been completed and delivered. The amount involved by these contracts is $144,750.

July 1, 1901, balance unexpended	$833,237.81
Amount appropriated by sundry civil act approved June 28, 1902	400,000.00
	1,233,237.81
June 30, 1902, amount expended during fiscal year	587,169.14
July 1, 1902, balance unexpended	646,068.67
July 1, 1902, outstanding liabilities	62,248.75
July 1, 1902, balance available	583,819.92
July 1, 1902, amount covered by uncompleted contracts	412,498.37
Amount (estimated) required for completion of existing project	495,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	400,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix O 11.)

11. Removing sunken vessels or craft obstructing or endangering navigation.—The wreck of the river steamer *Pete Craig*, in Savannah River near Twiggs Bar, was removed by hired labor, at a cost of $35.63.

(See Appendix O 12.)

IMPROVEMENT OF RIVERS AND HARBORS ON THE EASTERN COAST OF FLORIDA AND OF HARBOR AT KEY WEST, FLA., AND ENTRANCE THERETO.

This district was in the charge of Capt. Thomas H. Rees, Corps of Engineers, to August 10, 1901, with Lieut. Edmund M. Rhett, Corps of Engineers, under his immediate orders, in the temporary charge of Lieutenant Rhett from August 10 to September 11, 1901, and in the charge of Capt. Herbert Deakyne, Corps of Engineers, since September 11, 1901. Division Engineer, Col. Peter C. Hains, Corps of Engineers.

1. St. Johns River, Florida.—Previous to the commencement of improvement the mean low-water channel depth across the bar at the mouth varied from 5 to 7 feet, with a tidal range of 5.22 feet. This bar is formed of sand, and was extremely dangerous, as the channel across it shifted continually north and south through a range of about 1 mile.

The least mean low-water channel depth in the river was about 11.5 feet, all obstructions being sand or mud. The tidal range in the river varies from about 4.5 feet at the mouth to about 1 foot at Jacksonville.

The original plan of improvement contemplated the formation of a continuous channel with a mid depth of not less than 15 feet at mean low water from Jacksonville to the ocean, a distance of about 27.5 miles. The two points where work was required to gain this depth were at the bar at the mouth and in a reach of the river near Dames Point, 12 miles above.

The project of 1896 contemplated the dredging of a channel 300 feet wide and 24 feet deep through all shoals, and the construction of training dikes in the river proper, at an estimated cost of $600,000; also the extension of the north jetty at the mouth of the river 1,500 feet, and the south jetty 500 feet, and raising these jetties throughout their entire length, at an estimated cost of $1,509,750; in all $2,109,750.

The amount expended on this improvement by the United States up to June 30, 1902, was $1,815,195.61, of which $398,195.61 was under the present project.

Work on the north jetty at the entrance ceased on August 15, 1901, owing to the exhaustion of available funds. No work was done on the south jetty.

A survey for the purpose of establishing harbor lines at Jacksonville, Fla., was made in September and October, 1901.

The dredge *Winyah Bay* was sent to the St. Johns River for the purpose of dredging at the entrance.

At the time dredging ceased there was an available channel across the bar 15 feet in depth at mean low water and 100 feet wide in the narrowest part. Under natural influences the entire area of the shoal across the bar has since materially increased in depth. The dredged channel has been deepened about 1 foot and is much wider than when dredging ceased.

The river and harbor act of June 13, 1902, appropriated $350,000 for this improvement and authorized a continuing contract for the work to an additional amount not exceeding $950,000, and of said amounts an expenditure of $150,000 was authorized for the purchase or construction of a seagoing suction dredge.

At the end of the fiscal year an investigation was in progress regard-

ing the character of material to be found on a line across the peninsula back of Dames Point from Browns Creek to Dunns Creek.

Shoaling has continued in the channel around Dames Point and much difficulty is experienced by vessels in making the turn at that place.

The maximum draft that can be carried at mean low water over the shoalest part of the channel under improvement is 16 feet at the bar and 16½ feet at Dames Point. The mean rise of tide varies from 5.22 feet at the bar to 1.8 feet at Dames Point.

The commercial statistics furnished by the Jacksonville Board of Trade show that the value of the commerce of the port of Jacksonville is now about $26,000,000. As compared with the value placed upon the commerce of this port in 1895, this shows an increase of nearly 75 per cent.

GENERAL IMPROVEMENT.

July 1, 1901, balance unexpended	$66,139.38
Amount appropriated by river and harbor act approved June 13, 1902.	350,000.00
	416,139.38
June 30, 1902, amount expended during fiscal year	64,334.99
July 1, 1902, balance unexpended	351,804.39
July 1, 1902, outstanding liabilities	1,250.00
July 1, 1902, balance available	350,554.39
Amount (estimated) required for completion of existing project	1,359,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	200,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

MAINTENANCE.

Amount allotted from emergency act approved June 6, 1900	$10,000.00
June 30, 1902, amount expended during fiscal year	9,201.74
July 1, 1902, balance unexpended	798.26

(See Appendix P 1.)

2. St. Johns River at Orange Mills Flats, Florida.—By a resolution passed in May, 1898, Congress requested the Secretary of War to furnish information as to the condition of this locality with reference to navigation for ocean-going craft, and to submit an estimate of the cost of such improvement as might be necessary.

In response to this resolution a report was submitted and is printed on pages 1344 to 1348, Annual Report of the Chief of Engineers for 1898. This report contemplated the formation of a channel 200 feet wide and 13 feet deep at mean low water through the shoals between Jacksonville and Palatka, at an estimated cost of $120,000.

The river and harbor act approved March 3, 1899, adopted this project and appropriated the sum of $40,000 for carrying it into effect.

A survey was made in 1899, embracing the four shoals in the stretch between Jacksonville and Palatka. It was found that the ruling depths on these shoals were: Forresters Point Shoal, 11.6 feet; Orange Mills Flats Shoal, 9.8 feet; Racy Point Shoal, 10.7 feet; and Tocoi Shoal, 11.1 feet.

A contract for dredging through Orange Mills Flats proper was entered into November 14, 1899. Work was commenced under this

contract on April 2, 1900, and was completed October 23, 1900. A channel 13,164 feet long and from 120 to 160 feet wide was dredged, connecting the 13-foot contours on each side.

The amount expended on this improvement up to June 30, 1902, was $39,715.62.

While the available channel depth across Orange Mills Flats proper has been increased from 9.8 feet to 13 feet, the available depth is still limited by Racy Point Shoal to 10.7 feet, which was the maximum draft that could be carried at mean low water June 30, 1902.

Commerce has materially increased by reason of the increased facilities afforded.

The mean rise and fall of tide in this locality is 0.9 foot.

With the amount of $30,000 appropriated in act of June 13, 1902, it is proposed to complete the channel through Orange Mills Flats proper to a width of 200 feet, as called for by the project, and to expend the balance remaining in making a cut 120 feet wide through Racy Point Shoal and Tocoi Shoal.

July 1, 1901, balance unexpended	$285.53
Amount appropriated by river and harbor act approved June 13, 1892	30,000.00
	30,285.53
June 30, 1902, amount expended during fiscal year	1.15
July 1, 1902, balance unexpended	30,284.38

(See Appendix P 2.)

3. Volusia Bar, Florida.—The bar is located at the south end or head of Lake George, St. Johns River, about 162 miles from the mouth.

Before any improvement was commenced the channel over the bar was very crooked and had a least depth varying from 3½ feet to 4½ feet.

The project of 1879 contemplated the construction of two jetties carried out beyond the bar, with their outer ends from 200 to 250 feet apart.

With the appropriations made since the inception of the project two jetties have been built, starting from opposite sides of the river bank at the south edge of the lake and converging until upon the bar they are 230 feet apart. The east jetty is 3,400 feet long and the west jetty 2,200 feet. They are built to the level of mean low water throughout nearly their entire lengths. Two rows of firmly set piles provided with waling pieces confine boats to a 100-foot channel across the crest of the bar.

No work has been done during the past fiscal year.

The amount expended to June 30, 1902, was $31,000, of which $6,000 was for maintenance.

The maximum draft that can be carried through the improved channel at low water is 5 feet.

With the sum of $2,000 appropriated in act of June 13, 1902, for maintenance, and of which amount so much as may be necessary may be expended upon the St. Johns River between Volusia Bar and Lake Monroe, it is proposed to remove the worst obstructions within the limits named, by dredging, to such an extent as the available funds will admit.

The usual variation in level of the water surface is not in excess of 8 feet. It has been reported that the water has been known to be 1

foot below the plane of reference used, and in the river just above Volusia Bar it has been stated that the water has reached a stage 8 or 9 feet above the ordinary low-water level.

Although the commerce of this portion of the river is not of great magnitude, the river traffic exercises a controlling influence on railway rates, and for this reason is especially worthy of being fostered.

Amount appropriated by river and harbor act approved June 13, 1902 ...	$2,000.00
July 1, 1902, balance unexpended	2,000.00

(See Appendix P 3.)

4. Oklawaha River, Florida.—The Oklawaha River has its source in Lake Apopka, central Florida, flows slightly west of north for about 104 miles, measured along the axis of the channel, then almost due east for 21 miles farther, when it unites with the St. Johns River. The Oklawaha River is the principal outlet of a number of large lakes, the aggregate area of which is about 175 square miles.

From Lake Griffin down for a distance of about 28 miles the river flows through a wide savanna submerged about 1 foot under water and covered with a dense growth of saw grass. On this reach the river averages from 30 to 40 feet in width and has a least channel depth of about 5 feet; the current is very sluggish. The impediments to navigation on this portion of the river are the numerous bends, the narrow channel, floating islands, and eelgrass. From the savanna to the mouth, a distance of about 58 miles, the banks are covered with a dense growth of cypress and other timber. On this reach the river averages from 60 to 70 feet in width, and the least channel depth is 4 feet. The average velocity of the current is considerably greater than on the upper river, being 1.3 feet per second. The principal obstructions to navigation here are snags and overhanging trees.

The project for the improvement of the river, adopted June 23, 1891, consists in removing snags, overhanging trees, floating islands, and other obstructions of like character, so as to give a fair navigable channel of 4 feet depth from the mouth to Leesburg, at the head of Lake Griffin, a distance of 94 miles. The estimated cost of this work is $26,000.

The amount expended on this work to close of the fiscal year ending June 30, 1902, was $20,000. Of this sum the appropriations made since the act of September 19, 1890, aggregating $10,000, have been for maintenance.

There were no operations during the past year.

With the funds heretofore appropriated the stream has been cleared of obstructions for a distance of about 60 miles from the mouth. Additional obstructions accumulate from year to year which require removal in order to maintain the improvement already effected.

The mean draft that can be carried at low water is 4 feet.

With the sum of $2,000 appropriated in act of June 13, 1902, it is proposed to remove such snags and overhanging trees and sunken logs as have become obstructions from the mouth up as far as the funds available will admit.

Amount appropriated by river and harbor act approved June 13, 1902 ..	$2,000.00
July 1, 1902, balance unexpended	2,000.00

(See Appendix P 4.)

5. St. Augustine Harbor, Florida.—The original depth over the bar at the entrance to this harbor was from 6 to 9 feet at low water. The rise of tide varies from 4 to 6 feet.

An examination of this harbor was made in 1887 with a view to its improvement. The act of August 11, 1888, appropriated $35,000 for improving the harbor subject to the report of a Board of Engineers. It was decided that it was inexpedient to undertake the deepening of the harbor entrance at that time. In accordance with the recommendation of the Board it was directed by Department letter of February 20, 1889, that the funds available be expended in checking the erosion of the shore lines of the harbor entrance.

The approved project provided for the construction of spur jetties or groins of concrete and riprap on brush foundation mattresses with wing walls of riprap. Work under this project was begun October, 1889, and seven groins have been built, varying in length from 220 to 549 feet. Three of these groins were built on North Beach and four on Anastasia Island. Further appropriations, aggregating $36,000, were made in 1890, 1892, and 1894, making a total of $71,000. This work resulted in stopping the erosion on the north side of the entrance and checking that on the south side.

The heavy storms of the autumn of 1901 having caused a break in the shore line of Anastasia Island, the expenditure of the balance on hand in the construction of a timber dam was authorized January 18, 1902, and the work was commenced March 1, 1902, and completed June 14, 1902. This has resulted in the building up of the shore in front of the dam to a height of 4 feet and the effectual stopping of further encroachment of the sea at this point.

The amount expended up to June 30, 1902, was $70,071.31.

This improvement, being confined to the protection of the outer shore lines of the entrance, has had no effect whatever on the character and amount of commerce, which is practically nothing as far as water transportation is concerned.

The maximum draft that can be carried over the bar at mean low water varies from 6 to 9 feet.

July 1, 1901, balance unexpended	$6,000.10
June 30, 1902, amount expended during fiscal year	[a]5,071.31
July 1, 1902, balance unexpended	928.79
July 1, 1902, outstanding liabilities	155.00
July 1, 1902, balance available	773.79

(See Appendix P 5.)

6. Indian River, Florida, between Goat Creek and Jupiter Inlet.—A project adopted May 23, 1894, contemplated making a continuous channel 5 feet deep at low water and at least 75 feet wide in the straight reaches, with as much greater width in the turns as might be required, at an estimated cost of $44,000.

Work under the appropriation of July 13, 1892, was commenced by the U. S. dredge *Suwanee* July 28, 1895, and the channel previously dredged by the Florida Coast Line Canal and Transportation Company was widened at Long Canal, High Bank Canal, Curved Canal,

[a] Includes $150 for expenses of the Office of the Chief of Engineers.

and Conch Bar by dredging a cut 50 feet wide and 6 feet deep along one side.

The amount expended on this part of the river to June 30, 1902, was $15,000.

The act of June 13, 1902, appropriated $2,000 for continuing the improvement. The officer in charge states that this amount is inadequate to afford any relief to navigation interests under the present conditions and recommends that the expenditure of the appropriation be deferred until more favorable conditions obtain or until additional funds are provided.

A maximum draft can be carried through Indian River from Goat Creek to St. Lucia River of 5 feet at mean low water. Between St. Lucia River and Jupiter Inlet there is an available channel depth of only two feet at mean low water.

Negro Cut, Indian River Inlet.—The river and harbor act of August 18, 1894, appropriated $5,000 for dredging at this locality. The urgent deficiency act of March 2, 1895, made a further appropriation of $15,000 for the same work.

The present project, approved November 18, 1894, contemplates the formation of a channal 100 feet wide and 6 feet deep from the channel of Indian River through Negro Cut to the bar at Indian River Inlet, and the construction of a training wall for its protection, at an estimated cost of $32,775.

The channel called for by the project had been dredged by September 26, 1896, but being unprotected by the proposed training wall during the cessation of work from that time until June 25, 1901, extensive shoaling occurred.

With the appropriation of $7,500 made in act of June 3, 1896, and that of $5,000 made in act of March 3, 1899, a total of 37,103.9 cubic yards of material was removed from the channel, and two training walls of piles and brush over which dredged sand was deposited were built, one on each side of the channel, at its eastern end. The north training wall is 560.7 feet long and the south training wall is 880.6 feet long. This work began June 25, 1901, and ceased, owing to the exhaustion of available funds, January 13, 1902.

The amount expended on the improvement at Negro Cut to June 30, 1902, was $32,149.46.

Jupiter Inlet.—By act of Congress approved February 26, 1896, an appropriation of $500 was made to open this inlet for the passage of boats and small vessels. Work was begun September 5 and was satisfactorily completed September 19, 1896.

The inlet again closed in 1900. Under allotments of $1,000 from the emergency river and harbor appropriation of June 6, 1900, work of reopening the inlet was commenced February 6, but abandoned March 13, owing to the very low stage of the river.

In June, 1901, as a result of very heavy rains, the river rose so much that the citizens of the vicinity were able to complete the opening. It is believed that the inlet is in a satisfactory condition at the present time.

Transportation on Indian River has been decreased by the extension of the railroad along the west bank to Miami. The line of steamers which formerly ran on the river no longer does so.

JUPITER INLET.

July 1, 1901, balance unexpended	$30.75
June 30, 1902, amount expended during fiscal year	30.75

BETWEEN GOAT CREEK AND JUPITER INLET, INCLUDING NEGRO CUT.

July 1, 1901, balance unexpended	$11,141.13
Amount appropriated by river and harbor act approved June 13, 1902	2,000.00
	13,141.13
June 30, 1902, amount expended during fiscal year	10,790.59
July 1, 1902, balance unexpended	2,350.54

(See Appendix P 6.)

7. Biscayne Bay, Florida.—The original condition as to depth, width, and general availability for purposes of commerce is stated in detail in the report of a Board of Engineers constituted in accordance with the requirements of the river and harbor act of March 3, 1899, published in the Annual Report of the Chief of Engineers for 1900. At the time the survey was made, in August and September, 1899, as a result of dredging operations by the Florida East Coast Railway Company, there was a narrow channel in the bay 12 feet deep throughout and a ruling depth of 11½ feet on the bar at Cape Florida entrance.

The project adopted by the river and harbor act of June 13, 1902, contemplates the formation of a channel 18 feet deep from the wharves at Miami to the sea by way of a line entering the sea at a point about 4,000 feet north of Norris Cut, and a basin of same depth, 1,600 feet long and 500 feet wide, adjacent to the wharves at Miami. The act mentioned provides that of the work contemplated, the Florida East Coast Railway Company shall construct at its own expense the basin adjacent to the wharves at Miami, before described, and the channel from said basin to the east side of the refuge basin to be constructed on the east side of the bay. The act provides that the amounts appropriated and authorized shall be expended in constructing and protecting the portion of the channel extending to the sea from the terminus of the channel to be constructed by the railway company, of such approximately uniform depth and of such width as will best serve the interests of navigation, and as can be constructed with the funds therein appropriated and authorized. The act further provides that before any part of the appropriation shall be expended the said railway company shall enter into contract with the United States for the performing of its part of the work. This act appropriates $50,000 and authorizes a continuing contract for prosecuting the project for an additional amount not exceeding $250,000.

At the end of the fiscal year nothing had been done in furtherance of the project.

Amount appropriated by river and harbor act approved June 13, 1902	$50,000.00
July 1, 1902, balance unexpended	50,000.00

Amount (estimated) required for completion of existing project	$250,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	150,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix P 7.)

8. Harbor at Key West, Fla., and entrance thereto.—The work contemplated under this improvement is the deepening of the channel across the northwest bar. Previous to the inception of the project there was a depth of 10.5 feet on the bar at mean low water. The mean range of tide is 2.5 feet.

The existing project was submitted in November, 1889, and provides for the construction of a jetty on the northeast side of the passage, to be supplemented by a jetty on the western side.

It was thought, also, that dredging might be necessary. The depth of water to be obtained is 17 feet at mean low water.

The amount expended on this project to June 30, 1902, was $352,329.92.

No work in furtherance of the project was done during the past year.

At the beginning of the year the depth on the bar was 10 feet at mean low water. With allotments amounting to $10,000 from the emergency appropriation of June 6, 1900, dredging was done and a depth of 12.5 feet was restored at a cost of $8,777.80. So far as known this depth has been fairly well maintained to the close of the fiscal year.

GENERAL IMPROVEMENT.

July 1, 1901, balance unexpended	$318.33
Amount appropriated by river and harbor act approved June 13, 1902	100,000.00
	100,318.33
June 30, 1902, amount expended during fiscal year	148.25
July 1, 1902, balance unexpended	100,170.08

MAINTENANCE.

July 1, 1901, balance unexpended	$4,791.37
Amount allotted from emergency act approved June 6, 1900	5,000.00
	9,791.37
June 30, 1902, amount expended during fiscal year	8,777.80
July 1, 1902, balance unexpended	1,013.57

(See Appendix P 8.)

9. Removing the water hyacinth from Florida waters.—Under the provisions of the sundry civil act approved June 4, 1897, a Board of engineer officers was appointed to investigate the extent of the obstruction of the navigable streams of Florida, Louisiana, and other South Atlantic and Gulf States by the aquatic plant known as the water hyacinth, and to perform such experimental work as might be deemed necessary to determine a feasible method of checking or removing such obstructions.

The Board recommended the construction of a steamer fitted with crushing machinery, and the use of log booms as adjuncts to the operation of the boat.

The river and harbor act approved March 3, 1899, appropriated $25,000 for the construction of a boat, $1,000 for log booms, and $10,000 for operating expenses.

The construction of the boat was deferred until one intended for a similar purpose in the Louisiana district was tested. The work of the latter boat indicated, in the opinion of the officer in charge of this district, that the crushing process, even under the most favorable conditions, was too slow and expensive to be considered practicable, and a chemical process was recommended instead. The wording of the act

appropriating the funds available was such, however, as to prohibit its use in that manner. Awaiting further action by Congress nothing was done.

The act of June 13, 1902, appropriated $50,000 for the removal of the water hyacinth from the navigable waters of the States of Florida, Texas, and Louisiana, and authorized the Secretary of War to use this amount and the unexpended balance of amounts heretofore appropriated for this purpose in the States of Florida and Louisiana in exterminating or removing the plant by any mechanical, chemical, or other means whatsoever.

The interests of navigation are deeply involved in the removal of this obstruction and operations to that end will be conducted with vigor.

July 1, 1901, balance unexpended	$34,950.42
Amount appropriated by river and harbor act approved June 13, 1902 ($50,000 for States of Florida, Texas, and Louisiana)	(a)
	34,950.42
June 30, 1902, amount expended during fiscal year	34.81
July 1, 1902, balance unexpended	34,915.61

(See Appendix P 9.)

10. Dredge for river and harbor improvements in Florida.—The river and harbor act approved March 3, 1899, appropriated $35,000 for the construction of a dredge, with snagging outfit, for works on the coast of Florida and tributary waters. Specifications for a suitable boat were prepared and bids for the construction of a boat were opened March 7, 1901. The amount available was entirely inadequate, and all bids were rejected.

There are many improvements in this district for which the appropriations are so small and the work of such a varied and peculiar character that it is impracticable to have them done by contract. Work of this character has heretofore been done by the U. S. dredge and snag boat *Suwanee*, which is so old and so nearly worn-out that it requires special effort to keep her in commission, and a new boat is badly needed.

The act of June 13, 1902, appropriated an additional amount of $35,000 for the construction of a new boat. It is proposed immediately to proceed with the work.

July 1, 1901, balance unexpended	$31,665.68
Amount appropriated by river and harbor act approved June 13, 1902	35,000.00
July 1, 1902, balance unexpended	66,665.68

(See Appendix P 10.)

11. Removing sunken vessels or craft obstructing or endangering navigation.—The wreck of the bark *Ceres* was removed from Key West Harbor by James A. Lowe, of Key West, under contract dated December 23, 1901, for $1,090. The work was done in February and March, 1902, at a cost of $1,700.72.

(See Appendix P 11.)

[a] Up to close of fiscal year allotment of funds had not been made.

IMPROVEMENT OF RIVERS AND HARBORS ON THE WESTERN COAST OF FLORIDA, SOUTH OF AND INCLUDING SUWANEE RIVER.

This district was in the charge of Capt. Thomas H. Rees, Corps of Engineers, to August 10, 1901, with Lieut. Edmund M. Rhett, Corps of Engineers, under his immediate orders, in the temporary charge of Lieutenant Rhett from August 10 to September 11, 1901, and in the charge of Capt. Herbert Deakyne, Corps of Engineers, since September 11, 1901. Division Engineer, Col. Peter C. Hains, Corps of Engineers.

1. Kissimmee River, Florida.—The act of June 13, 1902, appropriated $8,000 for this improvement, which is a new work.

The Kissimmee River rises in Lake Tohopekaliga, upon which the town of Kissimmee is situated. It flows in a general southerly direction through Cypress Lake, Lake Hatchenecha, and Lake Kissimmee, and empties into Lake Okechobee.

The course of the river is very tortuous and a number of cuts known as canals have been made by interested parties for the purpose of avoiding the worst bends. The length of the waterway from the town of Kissimmee to Lake Okechobee is 137 miles.

The project calls for a channel 3 feet deep at ordinary stages of the river and 30 feet wide from Kissimmee to Fort Bassinger, a point on the river about 37.5 miles north of Lake Okechobee. The project also includes the improvement of Istokpoga Creek, a tributary 9.4 miles long, entering the Kissimmee 10.5 miles north of Fort Bassinger, to a depth of 3 feet and a width of 25 feet. Navigation is obstructed by shoals in the river and canals, and by shoals, snags, and overhanging trees in the creek.

Work on the improvement has not yet begun.

The commerce on the Kissimmee River consists mainly in the transportation of general supplies from Kissimmee to the settlements along the river. It is expected that this commerce will be considerably facilitated by the proposed improvement, and that the culture of oranges and other fruits in suitable lands in the valley of the river will be stimulated by improved facilities for transportation.

Amount appropriated by river and harbor act approved June 13, 1902 ..	$8,000.00
July 1, 1902, balance unexpended	8,000.00

(See Appendix Q 1.)

2. Orange River, Charlotte Harbor, and Caloosahatchee River, Florida.—The act of June 13, 1902, combines two improvements: First, the improvement of Orange River to a depth of 4 feet at mean low water, with a channel width of 50 feet, and second, the improvement of the channel between Punta Gorda, in Charlotte Harbor, and Myers, on the Caloosahatchee River, to a width of 100 feet and a depth of 7 feet at mean low water.

Orange River is a stream having a navigable length of 6 miles, which enters the Caloosahatchee River from the south about 6 miles above the town of Myers. The survey made in 1899 showed a general depth of 6 to 21 feet, with a limiting depth on shoals of about 2½ feet at mean low water, with a tidal range of nearly 1 foot. The estimated cost of the improvement is $2,500, and $500 per year for maintenance.

The waterway to be improved between Punta Gorda and Myers is known as Pine Island Sound. It is obstructed by two shoals, upon which dredging will be necessary to give the required depth of 7 feet

at mean low water. The mean range of tide is about 1.7 feet. The estimated cost is $6,000.

No work has yet been done on these improvements.

The commerce affected by these improvements consists of general merchandise, fruit, and vegetables. It is believed to be growing.

Amount appropriated by river and harbor act approved June 13, 1902 .. $9,500.00
July 1, 1902, balance unexpended 9,500.00

(See Appendix Q 2.)

3. Sarasota Bay, Florida.—Previous to any attempt at improvement there was a navigable channel with a minimum depth of 5 feet extending throughout the length of Big Sarasota Bay, excepting in two reaches, Palma Sola Pass and Long Bar, which have a total length of 5,400 feet. In these reaches the available depth was 4.3 and 3.5 feet, respectively.

Between Sarasota and Caseys Pass, at the south end of the bay, the available channel depth was 1.2 feet at mean low water, except through the Mangroves, where it was nothing.

The original project contemplated the formation of a continuous channel 100 feet wide and 5 feet deep at mean low water from Tampa Bay to the town of Sarasota, Fla., a distance of 21¼ miles, the estimated cost being $17,500.

The act of Congress of June 3, 1896, appropriated $2,500 for improving Sarasota Bay from Tampa Bay to Caseys Pass, while previous to that date the improvement was only for Sarasota Bay from Tampa Bay to Sarasota, Fla. The survey of 1889 was made, as directed, from Tampa Bay to Caseys Pass, and an estimate was presented amounting to $37,500 for securing a channel 75 feet wide and 3 feet deep at mean low water through the obstructing shoals below Sarasota. Under the act of June 3, 1896, the latter project is included in the improvement, so that the total estimate of cost for the modified project is now $55,000. The amount expended to June 30, 1902, was $17,500.

No work was done during the past fiscal year. So far as known the channel between Tampa Bay and the town of Sarasota, 5 feet deep at mean low water, has maintained itself during the year.

The channel to Caseys Pass has not been completed. A length of about 4,000 feet remains to be dredged before the channel will become available.

The mean range of tide is about 1.5 feet.

Amount appropriated by river and harbor act approved June 13, 1902 .. $5,000.00
July 1, 1902, balance unexpended 5,000.00

(See Appendix Q 3.)

4. Tampa Bay, Florida.—Tampa Bay is a large landlocked body of water, on the west coast of Florida, with an average width of from 6 to 7 miles, and a length, exclusive of its two tributary bays, of about 25 miles, in a general northeast and southwest direction. Its two tributary bays are Old Tampa Bay, entering at the northwestern end, and Hillsboro Bay, entering at the northeastern end.

Across the bar at the entrance and up to the point of division the channel has a depth of from 20 to 38 feet at mean low water. Old Tampa Bay is about 15 miles long, with an average width of 6 miles. Its narrowest point is where it joins Tampa Bay, where its width is a little less than 2½ miles. This bay is generally shallow, but at the

southern end has several deep channels. One of these leads along the eastern shore at a distance of about three-fourths mile from the beach and forms the approach to and harbor of Port Tampa.

Tampa Bay is the approach to the city of Tampa and to Port Tampa, the former at the head of Hillsboro Bay and the latter on the eastern shore of Old Tampa Bay. Port Tampa is about 9 miles from Tampa, with which it is connected by railway and of which it is the deep-water port.

Before improvement vessels drawing 12 feet could enter the bay and reach Ballast Point, while vessels drawing 8 feet could reach Tampa by taking advantage of the tide. Prior to 1888 operations were confined to dredging a 9-foot channel to Tampa, under project made in 1879.

In 1888 this project was modified and a provision included for forming a channel 200 feet wide and 20 feet deep at mean low water from the Gulf to Port Tampa. From 1880 to 1892 Congress appropriated for the improvement of Tampa Bay $130,000, being all the funds required by the original and modified projects. Of this amount $80,000 was expended on the channel from Tampa through Hillsboro River and Bay and the balance in dredging the bars at the mouth of Old Tampa Bay to form a channel to Port Tampa.

The Port Tampa channel was completed May 12, 1892. Up to that time about 115,000 cubic yards of material had been removed from the two bars and the channel contemplated by the project, 200 feet wide and 20 feet deep at mean low water, completed.

The present project was inaugurated by Congress under the act of March 3, 1899, in item of appropriation, as follows:

> Improving Tampa Bay, Florida: For improvement of Tampa Bay, Florida, from its entrance into the Gulf of Mexico to Port Tampa, seventy-five thousand dollars: *Provided*, That a contract or contracts may be entered into by the Secretary of War for such materials and work as may be necessary toward securing a channel depth of twenty-seven feet from said Gulf of Mexico to Port Tampa, and of a width five hundred feet across the bar and three hundred feet in the bay, as proposed in the report of November fourteenth, eighteen hundred and ninety-eight, published in House Document Number Fifty-two, Fifty-fifth Congress, third session, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate six hundred and seventy-five thousand dollars, exclusive of the amount herein appropriated.

Bids were opened for this work on June 29, 1899. It is proposed under the specifications to secure, first, a 24-foot depth throughout the channel in order to benefit commerce as quickly as possible, and afterwards to increase this depth to 27 feet.

The amount expended under the present project to June 30, 1902, was $172,630.81. None of this was expended for maintenance.

During the fiscal year ending June 30, 1902, work was continued in accordance with the project and under the continuing contract with the Alabama Dredging and Jetty Company. The amount of material dredged from the channel was 778,228.9 cubic yards. Three of the channel sections have been dredged to a depth of 24 feet in widths varying from 129 to 300 feet. Two other sections have been deepened 1 foot or more. The maximum draft at mean low water that can be carried over the shoalest part of the channel is 19.6 feet. Usual variation of level of water surface at outer end of channel is 1.54 feet; at inner end, 1.95 feet.

COMMERCIAL STATISTICS.

	Tons.
Phosphate rock:	
1891	15,482
1892	65,406
1893	98,637
1896	197,413
1897	165,606
1898	169,916
1899	201,403
1900	265,294
1901	352,972
Total commerce, including phosphate rock:	
1896	276,638
1898	236,156
1899	238,305
1900	350,761
1901	416,503

July 1, 1901, balance unexpended	$260,774.04
Amount appropriated by sundry civil act approved June 28, 1902	86,675.00
	347,449.04
June 30, 1902, amount expended during fiscal year	96,404.85
July 1, 1902, balance unexpended	251,044.19
July 1, 1902, outstanding liabilities	14,500.00
July 1, 1902, balance available	236,544.19
July 1, 1902, amount covered by uncompleted contracts	367,206.75
Amount (estimated) required for completion of existing project	326,325.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	140,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix Q 4.)

5. Hillsboro Bay, Florida.—Hillsboro Bay is the northeastern arm of Tampa Bay. It is about 10 miles long in a general north and south direction, and has an average width of about 4½ miles. The city of Tampa is located at the head of this bay at the mouth of the Hillsboro River. It is separated from the 12-foot depth in the bay by a flat about 3 miles wide. Originally there existed through this flat a narrow channel, with an average available depth of about 5 feet, formed by the waters of Hillsboro River.

The original project was adopted in 1879, and had for its object the formation of a 9-foot channel, 150 feet wide in the bay and 200 feet wide in the river, from the 9-foot curve in the bay to the wharves at Tampa in the Hillsboro River. Nearly $70,000 was expended under this project. In 1888 the project was modified to provide for the formation and maintenance of a channel 8 feet deep in Hillsboro Bay and Hillsboro River to the city of Tampa, and a channel 20 feet deep and 200 feet wide from the outer bar to Port Tampa.

Between 1880 and 1892 Congress appropriated $130,000 for the improvement of Tampa Bay, being all the funds required for the original and modified projects.

Work on the Hillsboro Bay channel was stopped June 3, 1893. The total amount expended on this improvement to June 30, 1898, was $80,000. At that date the channel at the mouth of the river was about

200 feet wide and 9 feet deep, but in the channel below there were places where the depth was only 7 feet and the width less than 80 feet.

The present project, inaugurated by Congress under the act of March 3, 1899, contemplates the formation of a channel in Hillsboro River, from a point about 100 feet south of the bridge crossing the river at Lafayette street to the mouth of the river, and from there along the line of shortest distance to the 12-foot contour in Hillsboro Bay; this channel is to be 12 feet deep at mean low water, 200 feet wide in the river, and 150 feet wide in the bay. The estimated cost of the proposed work is $300,000, with $1,000 annually for maintenance.

The amount expended under the existing project to June 30, 1902, was $115,707.13. No expenditures have been made for maintenance.

During the past year no work was done, the amount available previous to the passage of the act of June 13, 1902, being too small to be expended advantageously.

July 1, 1901, balance unexpended	[a]$12,361.85
Amount appropriated by river and harbor act approved June 13, 1902	150,000.00
	162,361.85
June 30, 1902, amount expended during fiscal year	3,068.98
July 1, 1902, balance unexpended	159,292.87

(See Appendix Q 5.)

6. Crystal, Manatee, Anclote, Suwanee, and Withlacoochee rivers, Florida.—These improvements were consolidated under one appropriation by the act of June 13, 1902, which appropriated $35,000 to be applied to these five localities. At the same time the act appropriated the additional sum of $15,000 to be applied to deepening the channel from the mouth of the Withlacoochee River to the loading pool in the Gulf of Mexico to a depth of 8 feet. Allotments from the consolidated appropriation have not yet been made.

(*a*) *Crystal River.*—This is a new work. Operations have not yet begun.

Crystal River is a small tidal estuary emptying into the Gulf of Mexico on the west coast of Florida about 25 miles southeast of Cedar Keys. It flows in a westerly direction from the town of Crystal River, which is practically the head of navigation, to its mouth, a distance of 6¼ miles. Widths are generally from 300 to 700 feet and the depths in the river are ample, being generally over 10 feet and at no point less than 7.4 feet, except near the mouth and over a length of 2,000 feet near the wharves of the town of Crystal River, at which points the depths are less than 6 feet. These satisfactory conditions are nullified by the existence of oyster and rock reefs and sand bars obstructing the approaches to the mouth of the river in Crystal Bay. Through these reefs there is at present a tortuous channel, difficult and dangerous of navigation, with a depth at one point of only 2.7 feet at mean low water. The mean range of tide is about 2.3 feet.

The project contemplates the formation of a channel through the shoal places 6 feet deep at mean low water and 60 feet wide. The estimated cost is $84,647.46.

The town of Crystal River is the center of a productive tributary region of some 400 square miles in extent, much of which is rich in

[a] Increase of $3.33 on account of refundment.

phosphate deposits that would naturally seek an outlet through Crystal River if the channel depths were sufficient for the purpose. Other products of this region are fruits, fish and oysters, lumber, and naval stores.

(*b*) *Manatee River.*—For 12 miles from its mouth in Tampa Bay this river has the characteristics of an estuary. Previous to improvement in the estuary the general depth of the river varied from 7 to 20 feet. At the mouth there was a long shoal with a depth of 7 feet. Between Palmetto and Braidentown there was another bar covered by from 3 to 5 feet of water.

An examination of the river with a view to its improvement was made in 1881, and a project adopted in 1882 which contemplated forming a channel 100 feet wide and 13 feet deep from Tampa Bay to Shaw and McNeills points.

In 1886 the project was modified so as to provide a channel 100 feet wide and 8 feet deep at mean low water from Tampa Bay to Manatee, Fla.

This channel was completed, and in 1892 the original project was again adopted. The revised estimate for this work is $73,000.

Under the terms of the river and harbor act of June 3, 1886, which provided that $3,000, or so much thereof as necessary, of the funds appropriated for improving this river should be used in improving the cut-off into Terraceia Bay, a project for making a channel through the cut-off 100 feet wide and 6 feet deep was submitted, and approved on June 23, 1897. It was estimated that this channel would cost $20,000. Previous to improvement there was a channel through this cut-off, for rowboats only, of 1 foot at mean low water.

A further sum of $8,000 was made available for this cut by the act of March 3, 1899, which appropriated $10,000 for improving Manatee River. The cut was practically completed during the year ending June 30, 1900.

No work was done during the year ending June 30, 1902.

The amount expended to June 30, 1902, on the entire improvement was $57,000.

The condition of the river on June 30, 1900, was such that at mean low water a least depth of 9 feet could be obtained from Tampa Bay up the river to Braidentown, 8 feet to Ellenton, and 7 feet to Rocky Bluff, which is about 11 miles from the bay. At the same time a draft of 6 feet could be carried through Terraceia Cut-off. So far as known these depths have not materially decreased since that date.

The mean range of tide is about 1.7 feet.

The commerce of the locality consists of agricultural products, fertilizers, lumber, and general merchandise.

The increase in tonnage due to improvement of this stream for several years past is shown by the following statement:

	Tons.		Tons.
1893	6,872	1897	23,800
1894	11,552	1898	24,310
1895	11,718	1899	43,542
1896	21,000	1900	55,162

(*c*) *Anclote River.*—This river has a total length of about 20 miles, and is a small stream until it reaches a point about 3 miles from the mouth, where it receives the water flowing from a large spring called Tarpon Springs, situated at the head of Tarpon Bayou, through

which it flows into the Anclote River. The thriving town of Tarpon Springs is located about the head of the bayou and between it and the river. The river below Tarpon Springs is badly obstructed by sand shoals and oyster bars, through which the channel pursues a narrow and tortuous way, with a depth varying from 2 to 14 feet at mean low water.

The existing project was adopted by the river and harbor act of March 3, 1899, and contemplates securing a channel 100 feet wide and 6 feet deep at mean low water from Anclote anchorage to Sponge Harbor, and thence 4 feet deep at mean low water to the county bridge at Tarpon Springs, at an estimated cost of $51,500.

The amount expended to June 30, 1901, was $5,000.

At that date a cut 50 feet wide and 7 feet deep at mean low water had been made through the worst shoals.

No work was done during the year ending June 30, 1902, no funds being available.

The available depth throughout the channel is still limited to about 3 feet at mean low water on shoals that have not yet been dredged. The mean range of tide is 2 feet.

The commerce of the locality consists of lumber, fruit, and sponges.

(*d*) *Suwanee River.*—The project for the improvement of the Suwanee River was adopted in 1879. The reach of the river covered by the project extended from its mouth in the Gulf of Mexico to Ellaville, a distance of 135 miles. At that time the obstructions in this portion of the river consisted of shoals composed of soft, unstratified limestone mixed with flint, extending partly or entirely across the river, in some instances covered with shallow deposits of sand and in others bare; also snags and overhanging trees. The channels across these shoals were often narrow and very crooked. Their depth at mean low water would vary from 15 inches to 3 feet. At places large isolated limestone bowlders in the channel were imminent sources of danger to navigation.

An examination of the river with a view to its improvement was made in 1879. The estimated cost of the work to be done was $55,158.

The proposed improvement consists in deepening the bar at the passes by dredging, the removal of snags and overhanging trees along the river, and deepening and improving the channel at various places by the removal of rocks and snags and construction of wing dams, so as to straighten, widen, and deepen the channel. The depth to be obtained is 5 feet through the bars at the passes for a width of 150 feet and up the river as far as Rollands Bluff (Branford), a distance of 75 miles. From there to Ellaville, a distance of 60 miles, the depth is to be 4 feet and the width 60 feet. The amount expended to June 30, 1902, was $55,000.

The maximum draft that can be carried at low water is 5 feet from the Gulf to Branford and 3 feet from there to Hudson, 10 miles below Ellaville.

The mean range of tide at the mouth of the Suwanee River is about 2.4 feet.

The commerce of the river consists chiefly of agricultural products, fertilizers, lumber, and naval stores.

(*e*) *Withlacoochee River.*—Before improvement this river was badly obstructed by ledges of limestone rock, sand bars, snags, and overhanging trees. The general depth was from 1 to 7.5 feet with a width

from 75 to 180 feet. The obstructions prevented regular navigation and the river was used only for rafting cedar logs or by an occasional push boat.

The project for improvement, submitted in 1879, calls for the removal of snags, loose rocks, overhanging trees, and the deepening of some of the prominent shoals and a bar at the mouth, so as to form a channel having an available depth of 2 feet during about half the year from the mouth of the river in the Gulf of Mexico to Pembertons Ferry, a distance of 77 miles. The project was practically completed November 14, 1892.

The amount expended to June 30, 1902, was $24,288.67.

The improvement has not resulted in any marked benefit to commerce, because the period during which navigation is open does not correspond with the season when it is necessary to move the horticultural products of the region.

The maximum draft that can be carried to the head of navigation in the river is 2 feet.

Large deposits of phosphate have been discovered along the river since the original project for improvement was inaugurated.

Under plans that received the approval of the Secretary of War April 21, 1894, and subject to inspection by the district engineer officer, the Dunnellon Phosphate Company is engaged in deepening a channel from the mouth of the river to the Gulf of Mexico, in order that the products of the mines may be lightered to vessels in the outer anchorage.

No work was done by the United States during the year ending June 30, 1902, except to make a survey of the channels dredged by the Dunnellon Phosphate Company. This survey was made in October and November, 1901, and showed that a channel about 11,780 feet long had been excavated to a width of 100 feet and an average depth of about 8 feet, but that the depth was not uniform. The worst place in this channel had a practicable depth of 5.9 feet at mean low water.

The mean range of tide is about 2 feet.

The commerce affected by the improvement of this river consists of the agricultural and lumber interests, and especially the phosphate industry.

CONSOLIDATED APPROPRIATION.

July 1, 1901, balance unexpended	$974.14
Amount appropriated by river and harbor act approved June 13, 1902	35,000.00
	35,974.14
June 30, 1902, amount expended during fiscal year	[a]562.81
July 1, 1902, balance unexpended	35,411.33

SPECIAL FOR WITHLACOOCHEE RIVER.

Amount appropriated by river and harbor act approved June 13, 1902	$15,000.00
July 1, 1902, balance unexpended	15,000.00

(See Appendix Q 6.)

7. *Removing sunken vessels or craft obstructing or endangering navigation.*—The boiler of the abandoned steamer *Kissimmee* was removed from the channel of Hillsboro Bay, near Tampa, on October 16, 1901, under contract, at a cost of $100.

(See Appendix Q 7.)

[a] Includes $250 for expenses Office Chief of Engineers.

EXAMINATION AND SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 3, 1899.

Reports dated August 23, 1899, by Capt. Henry Jervey, Corps of Engineers, and December 14, 1901, by Capt. Herbert Deakyne, Corps of Engineers, on a preliminary examination and survey, respectively, of *Kissimmee River, Florida, and connecting lakes and canals flowing into Lake Okechobee, thence down the Caloosahatchee River to the Gulf of Mexico, with a view to improving the navigation of the channels therein*, were submitted through the division engineer. The plan of improvement presented by Captain Deakyne in his report is estimated to cost $24,220.90. The reports were transmitted to Congress and printed in House Doc. No. 176, Fifty-seventh Congress, first session. (See also Appendix Q 8.)

IMPROVEMENT OF RIVERS AND HARBORS IN WESTERN GEORGIA AND FLORIDA AND IN EASTERN ALABAMA.

This district was in the charge of Capt. W. V. Judson, Corps of Engineers, to November 4, 1901, and of Lieut. Robert R. Raymond, Corps of Engineers, since that date. Division Engineer, Col. Peter C. Hains, Corps of Engineers, to July 24, 1901, and Lieut. Col. H. M. Adams, Corps of Engineers, since that date.

1. Carrabelle bar and harbor, Florida.—The town of Carrabelle is situated about 20 miles east of Apalachicola, on Carrabelle River, which empties into St. George Sound. The river forms the inner harbor, and the channel along the water front varies from 9 to 15 feet in depth, with a width of about 100 feet.

A bar 6,000 feet wide between 10-foot contours interposes between the inner harbor above mentioned and Dog Island anchorage, a protected portion of St. George Sound, showing 4-fathom depth over a considerable area.

Vessels enter Dog Island anchorage from the Gulf of Mexico via East Pass, which has limiting low-water depths of about 17 feet.

The river and harbor act of June 3, 1896, adopted a project for improvement, and appropiated $10,000 to be used in making a 10-foot channel by dredging from the mouth of Carrabelle River to the channel in the bay (St. George Sound).

No estimate of the cost of this improvement had then been submitted.

The river and harbor act of March 3, 1899, provided for examination of East Pass. Report upon the same, with plan and estimates for improvement, is published on page 2152 et seq., Annual Report of the Chief of Engineers for 1900. This proposed project involves securing a channel across the sea bar, 20½ feet deep and 150 feet wide, at a cost of $18,950, and closing an opening in Dog Island at a cost of $8,500.

The emergency river and harbor act of June 6, 1900, provided for an examination and survey of Carrabelle Harbor. Report upon same is published in Annual Report of the Chief of Engineers for 1901, page 1800 et seq.

This proposed project involves securing a channel 10 feet deep and 100 feet wide from Dog Island anchorage (St. George Sound) to the city of Carrabelle, at a cost of $47,300. This estimate is the only one

made from an actual survey, and the project is practically identical with the project already adopted by Congress.

The amount expended up to the close of the fiscal year ending June 30, 1902, was $21,704.08, and the work has been confined to dredging upon the bar at the river mouth.

No work was carried on during the past fiscal year.

The maximum draft that could be carried through the channel, at mean low water, on June 30, 1901, was 6 feet, although only one lump showed so shoal a depth, there being generally from 7 to 8 feet in the dredged channel. No shoaling in this channel has been reported since that date.

The commerce of the port of Carrabelle, Fla., consists principally of timber, naval stores, dressed and kiln-dried lumber, shingles, and miscellaneous articles. The value of exports, foreign and domestic, of lumber and naval stores during the fiscal year has been returned at $499,789.12.

July 1, 1901, balance unexpended	$91.35
Amount appropriated by river and harbor act approved June 13, 1902	20,000.00
	20,091.35
June 30, 1902, amount expended during fiscal year	91.35
July 1, 1902, balance unexpended	20,000.00

(See Appendix R 1.)

2. Apalachicola Bay, Florida.—The town of Apalachicola lies at the mouth of the river of that name, the deep water of which forms its inner harbor. Between the inner harbor and a considerable 3-fathom anchorage area in Apalachicola Bay interposes a bar at the river mouth, the average width of which was originally 7,000 feet between 8-foot contours and the minimum depth 3.5 feet.

Across this bar the lumber exported is lightered either to the 3-fathom anchorage area in Apalachicola Bay or through Bulkhead Shoals to the anchorage of Carrabelle, the latter some 20 miles distant. The 3-fathom anchorage area is entered via West Pass, where originally the depth was about 13 feet. The original depth over Bulkhead Shoals was less than 4 feet.

The existing project, except for Bulkhead Shoals, approved by act of March 3, 1899, provides for a channel 18 feet deep at mean low water through the West Pass, along the northern shore of St. George Island, and across the bay to the water front of Apalachicola, estimated to cost $350,000, and $20,000 or $30,000 annually for maintenance of completed work.

The project for improvement of Bulkhead Shoals was adopted in 1891, and involved the dredging of a channel 100 feet wide and 9 feet deep.

The amount expended on this improvement up to the close of the fiscal year ending June 30, 1902, including the cost of channel dug through Bulkhead Shoals, was $174,000.

Nothing has been done during the past fiscal year.

The channel through the Bulkhead Shoals remains practically as when dredged in 1892, with a minimum low-water depth of about 8 feet.

The channel over the bar at the river mouth has been gradually shoaling since the last dredging was done in 1897, and is now very

troublesome and expensive to the lighterage business crossing it. The maximum depth that can be carried across it at mean low water is but 5 feet.

The channel across the sea bar at West Pass, which was dredged to 17 feet in 1900, shows now a maximum available low-water depth of about 15 feet. The general depths are much greater than this; in fact, the channel has remained practically as dredged, except at the extreme outer end of the channel, where a lump has formed with the minimum depth stated. Due to the formation of this lump, many vessels loaded Apalachicola lumber at the anchorage near Carrabelle, although some use was made of West Pass.

The commerce of this port is in timber, cotton, naval stores, staves, a large quantity of dressed and kiln-dried lumber, shingles, laths, and miscellaneous freight.

July 1, 1901, balance unexpended	$130.32
Amount appropriated by river and harbor act approved June 13, 1902	40,000.00
	40,130.32
June 30, 1902, amount expended during fiscal year	130.32
July 1, 1902, balance unexpended	40,000.00

(See Appendix R 2.)

3. Apalachicola River, the Cut-off, and Lower Chipola River, Florida.—The Apalachicola River from the junction of the Chattahoochee and Flint rivers to the Gulf of Mexico (Apalachicola Bay) has a length of about 137 miles, and a low-water slope of about 3 inches to the mile, as indicated by the best data at hand. The width varies from 150 to 300 yards, and the available depth was originally 6 feet at low water, except where obstructed by snags and sunken logs.

The Confederate authorities obstructed the channel at a point about 47 miles above the mouth, causing the river to break through by a channel known as Moccasin Slough, into the river Styx, the latter a tributary entering the Apalachicola a few miles below the Confederate obstructions. Moccasin Slough was very narrow and tortuous and much obstructed by rafts of logs, etc. The old channel has gradually filled up.

About 55 miles above the mouth steamboats may leave the river, reentering it about 17 miles farther down, after passing through the Cut-off, Lower Chipola River, and Lee Slough, thus making several important landings.

The original project, approved by the act of June 3, 1874, contemplated securing a channel 100 feet wide and 6 feet deep at low water by the removal of snags and overhanging trees, and widening and straightening Moccasin Slough and the Elbows, at an estimated cost of $80,333.

Act of September 19, 1890, approved of an addition to the project involving the clearing of a channel 60 feet wide and 5 feet deep through the Cut-off, Lee Slough, and the Chipola River, at a cost of $7,500.

The amount expended on work under this project to the close of the fiscal year ending June 30, 1902, was $64,000. This expenditure has improved Moccasin Slough sufficiently for present purposes and maintained the river reasonably free from snags, etc.

No work has been done during the past fiscal year.

The commerce of this river is so combined with that of the Chattahoochee and Flint rivers that a separation is impossible. The commerce of all these streams amounted to about $2,000,000 in 1898, about $4,000,000 in 1899, about $4,777,000 in 1900, about $11,000,000 in 1901, and about $11,500,000 in 1902.

Amount appropriated by river and harbor act approved June 13, 1902 .. $6,000.00
July 1, 1902, balance unexpended 6,000.00

(See Appendix R 3.)

4. Upper Chipola River, Florida, from Marianna to its mouth.—The river from Marianna to the head of the Dead Lakes has a general low-water depth of 5 feet and width varying from 60 to 200 feet. It is greatly obstructed by rock shoals, snags, and overhanging trees. Three bridges form obstructions, their headways above low water being 17, 16, and 15 feet, respectively.

At one shoal ("Look and Tremble") there is a fall of 5 feet in 40 over rock bottom. This shoal is about 20 miles above the Dead Lakes. Between this shoal and the Dead Lakes there is at Sister Islands a mud bar, over which but 2 feet can be carried at low water.

No funds were available for the improvement of this stream until an appropriation of $5,000 was made by the act of March 3, 1899, to be expended in accordance with project submitted. The project contemplates clearing out a low-water channel 3 feet deep and 60 feet wide from Marianna to the foot of the Dead Lakes, estimated to cost $41,000, exclusive of necessary plant, which would comprise a snag boat, drilling barge, and dump scow. (See Annual Report of the Chief of Engineers for 1889, p. 1417.)

The amount expended to June 30, 1902, was $5,000, which resulted in the removal of snags, logs, etc., from Marianna to Sister Islands.

Nothing has been done during the past fiscal year. The river is still obstructed by shoals at Sister Islands, Look and Tremble, and at numerous points above, as well as by the bridges mentioned. The channel below Sister Islands is much obstructed by snags and logs, and this same condition obtains through the Dead Lakes, which must be traversed by boats for 20 miles on their way to the Apalachicola River via the Cut-Off and Lower Chipola River and Lee Slough.

The commerce of this stream consists principally of naval stores, round and square timber, lumber, and other miscellaneous freights, the estimated value of which was on June 30, 1902, $400,000.

Large quantities of pine and cypress timber are rafted down this stream, the value of which is not known.

Amount appropriated by river and harbor act approved June 13, 1902... $2,000.00
July 1, 1902, balance unexpended 2,000.00

(See Appendix R 4.)

5. Flint River, Georgia.—At low water this river was navigable for boats drawing 3 feet from its mouth to Bainbridge, a distance of 36 miles, but the channel was narrow, crooked, and greatly obstructed by logs, snags, and overhanging trees. Above Bainbridge the channel was so obstructed by rock shoals, loose rock, and bowlders that there was no navigation except on a rise of 5 feet, when steamboats could run to Albany, 105 miles above the mouth. Above Albany to Montezuma, the latter point 182 miles above the mouth, the channel was so obstructed by sand and rock shoals, bowlders, snags, logs, and overhanging trees that the river was not navigable at a low-water stage.

The original project called for a channel 100 feet wide and 3 feet deep at extreme low water from the mouth of the river to Albany, Ga., at an estimated cost of $184,862.

This project was amended in 1870 to give a channel for light-draft steamers at moderate stages of water from Albany to Montezuma by the removal of logs, snags, and overhanging trees, cutting through rock reefs, and deepening sand bars by contraction works, at a cost of $15,000.

The amount expended up to the close of the fiscal year ending June 30, 1902, was $210,859.49. As the result of work done the river is now navigable throughout the year from Albany down to Newton, 33¼ miles, and from Bainbridge to the mouth, 36 miles, there being a good channel, with 3 feet available at low water, throughout these sections.

Between Bainbridge and Newton, 35¾ miles, boats do not attempt to run through except at a 5-foot stage, as the channel is still much obstructed by logs, snags, bowlders, and rock reefs. Considerable work has been done between these points, however, and the same will be available when the improvement of this section has been completed.

Between Albany and Montezuma, 77 miles, no navigation is attempted, as the river is much obstructed in a manner similar to the section last mentioned. This portion of the river has been repeatedly cleared of snags, etc., in accordance with the project, and it is recommended that for the present no further work be done thereon.

No work was done on this improvement during the past fiscal year.

The commerce of the lower part of this stream is so combined with that of the Chattahoochee and Apalachicola rivers that it is impossible to give a statement in regard to it. The commerce of that part below Albany, down as far as the improvement has been carried, is estimated to be 17,312 tons, valued at $865,000, for the past fiscal year.

July 1, 1901, balance unexpended		$570.66
Amount appropriated by river and harbor act approved June 13, 1902		25,000.00
		25,570.66
June 30, 1902, amount expended during fiscal year		430.15
July 1, 1902, balance unexpended		25,140.51
July 1, 1902, outstanding liabilities		5.94
July 1, 1902, balance available		25,134.57

(See Appendix R 5.)

6. Chattahoochee River, Georgia and Alabama, below Columbus.—Columbus, Ga., lies 223 miles above the junction of this river with the Flint, and 360 miles above the mouth of the Apalachicola River, which is formed by the confluence of the Chattahoochee and the Flint. Columbus is at the head of navigation, and boats have always ascended to this point, but navigation was originally difficult and dangerous by day and impossible by night, owing to the large accumulation of logs, snags, and overhanging trees, and sand, rock, and marl shoals obstructing the channel.

The project for improvement, adopted in 1873, provided for a low-water channel 100 feet wide and 4 feet deep from Columbus, Ga., to Chattahoochee, Fla., at the junction of the Flint, which was to be obtained by the removal of logs, snags, and overhanging trees, cutting through the rock and marl shoals, and scouring out sand bars by works

of contraction and shore protection. The estimated cost of this work from Chattahoochee, Fla., to Eufaula, Ala., 139 miles, was $145,247. No estimate of cost for that part between Eufaula, Ala., and Columbus, Ga., was made.

The amount expended on this work to the close of the fiscal year ending June 30, 1902, was $352,536.83.

The river was in a fair condition at that date, with an available low-water depth of 3½ feet below Eufaula, Ala., but between Eufaula and Columbus there were a number of bars and isolated obstructions which caused trouble, particularly at extreme low stages of the river. Navigation above Eufaula was then virtually suspended.

During the past fiscal year snags were removed from the river throughout its length, and work of jetty repairs and extension and marl excavation was carried on at a few of the worst places.

The river is constantly receiving an influx of snags from caving banks. These must be removed annually. A large number of sand bars and shoals still need improvement between Columbus, Ga., and Eufaula, Ala., and the wing dams and training walls built in the past require repairs and maintenance.

The minimum draft that can be carried over the shoalest part of the river under improvement is scant 3 feet.

The commerce of this stream is so combined with that of the Flint and Apalachicola rivers that a separation is impossible. It is stated under the report of the Flint River as being 120,738 tons, valued at $11,500,000, in 1902, as against 118,765 tons, valued at $11,146,125, in 1901.

July 1, 1901, balance unexpended, general improvement	$18,210.85	
July 1, 1901, balance unexpended between West Point and Franklin	280.78	
		$18,491.63
Amount appropriated by river and harbor act approved June 13, 1902		100,000.00
		118,491.63
June 30, 1902, amount expended during fiscal year		15,747.68
July 1, 1902, balance unexpended		102,743.95
July 1, 1902, outstanding liabilities		470.90
July 1, 1902, balance available		102,273.05

(See Appendix R 6.)

7. Choctawhatchee River, Florida and Alabama.—The Choctawhatchee River is 162 miles long, from Newton, Ala., to its mouth in Choctawhatchee Bay, an arm of the Gulf of Mexico. Hollis Bridge is 7 miles, Pate Landing 12 miles, Geneva 37 miles, and Caryville 62 miles below Newton.

Originally the channel was much obstructed by snags, logs, sand, and gravel bars.

The project for the improvement, as amended in 1890, contemplates the creation of a low-water navigable channel throughout, by removing logs, snags, and overhanging trees, by excavating rock and marl shoals, and by contraction works and shore protection.

The amount expended on this river under the existing project up to close of the fiscal year ending June 30, 1902, was $146,776.77.

The work done has secured a fairly navigable channel from Geneva to Caryville with a low-water depth of 3½ feet. Between Pate Landing, on the upper portion of the river, and Geneva a partially

improved channel exists, which was occasionally used by steamboats, but since the building of the railroads, one each touching Newton and Geneva and one crossing the river between, no steamboats have made use of this part of the river.

Below Caryville there is no steamboat navigation at present, but large quantities of saw logs and hewn timber are floated down. Below Caryville the work of first importance is the deepening of the bar at the mouth of the river (Cypress Top) to 5 feet to enable tugs to handle the timber floated down.

During the fiscal year ending June 30, 1902, no work was done.

On December 10, 1900, the snag boat *Choctawhatchee* was snagged and sunk near Pate Landing. A new hull for this boat has been completed and is now awaiting installation of boiler and machinery.

The commerce of this stream is mainly saw logs, timber, and lumber, the value of which for the fiscal year ending June 30, 1902, is estimated to be about $100,000.

July 1, 1901, balance unexpended	$1,786.87
Amount appropriated by river and harbor act approved June 13, 1902	16,000.00
	17,786.87
June 30, 1902, amount expended during fiscal year	1,563.64
July 1, 1902, balance unexpended	16,223.23
July 1, 1902, outstanding liabilities	49.50
July 1, 1902, balance available	16,173.73

(See Appendix R 7.)

8. La Grange Bayou, Florida, including Holmes River, Florida, from Vernon to its mouth.—Holmes River empties into the Choctawhatchee River about 40 miles above the mouth of the latter. It is a wide and deep stream to the town of Vernon, 25 miles above its mouth, but was originally greatly obstructed by sunken logs, fallen timber, and overhanging trees, and was only available for navigation by small sailing craft and barges, which occasionally made trips up to Vernon.

The present project for the improvement of the stream provides for making a navigable channel by removing logs and snags from the channel and overhanging trees from its banks, from its mouth up to the town of Vernon.

The total amount expended on this improvement up to the close of the fiscal year ending June 30, 1902, was $7,929.80, of which $5,769 was upon Holmes River and $2,160.80 upon La Grange Bayou, and resulted in clearing the channel of all obstructions that were then found, making the channel sufficiently available for the small craft that used the stream.

Nothing was done during the past fiscal year.

The commerce of the stream consists of cotton, turpentine, rosin, molasses, honey, and miscellaneous articles, which are carried by water to Pensacola to market.

July 1, 1901, balance unexpended	$2,220.20
June 30, 1902, amount expended during fiscal year	150.00
July 1, 1902, balance unexpended	2,070.20

(See Appendix R 8.)

9. Harbor at Pensacola, Fla.—The available depth across the inner bar at the entrance to this harbor in 1879, previous to any work

of improvement, was 19.5 feet, the width of the channel being contracted by the growth of the Middle Ground Shoal to the southward. The harbor entrance and channel way was also obstructed by wrecks, and the western shore line in the vicinity of Fort McRee was cutting away rapidly, and almost the whole of the old Fort McRee has been washed away.

The project of 1877 considered only the removal of the wrecks; that of 1878 called for the removal of these wrecks and for making a survey to determine further recommendations for improvement. The project of 1881 provided for dredging a channel 300 feet wide and 24 feet deep at mean low water for the temporary relief of navigation, and also for protecting the shore line near Fort McRee with a view to preventing further injurious changes. Dredging under this project was carried on at various times between 1881 and 1893, and at the close of the dredging operations in August, 1893, the available channel was 225 feet wide, and with a depth of 24 feet at mean low water. Two groins, one 360 feet and the other 220 feet long, were completed in 1890, and still serve the purpose of holding the shore line.

In 1891 a special Board of Engineers presented a project for opening a new channel across the Caucus Shoal, following the direction of the ebb current, by means of two jetties, assisted by dredging if necessary. In 1895, upon the report of a special Board of Engineers, no change was made in the project of 1891, but it was recommended that dredging be tried, using one of the hydraulic dredges belonging to the United States, to open up a channel 26 feet deep at mean low water, and as wide as practicable on the line of deepest water across the Caucus Shoal and approximately on the line of the axis of the jettied channel proposed by the Board of Engineers in 1891. In December, 1895, this channel was opened by the United States dredge *Gedney* to a width of 120 feet and depth of 24 feet at mean low water. The channel across Caucus Shoal, now known as Caucus Channel, has a length of about 10,000 feet.

In 1896 the same Board that recommended the first amendment to the project of 1891 submitted a second amendment to expend all funds available in continuing the work of dredging across the Caucus Shoal, and if funds sufficient were made available by Congress to build a dredge and open the channel across the Caucus Shoal to a width of at least 300 feet and a 30-foot depth at mean low water, with such side slopes as the material would assume. Until a channel be opened by dredging across the Caucus Shoal, as above proposed, the Board recommended that the construction of the jetties for its maintenance be not considered.

The river and harbor act of March 3, 1899, extended this project to "securing a channel depth of 30 feet at mean low water from the Gulf of Mexico to the dock line at the east end of the city of Pensacola."

The amount expended up to the close of the fiscal year ending June 30, 1902, was $721,338.21. The work done resulted in the removal of the wrecks obstructing the channel; the construction of two groins near old Fort McRee, which have served the purpose of retaining the shore line and are now in good condition; in dredging a large amount of material from the inner bar, and in opening up an entirely new 30-foot channel across the Caucus Shoal.

With a balance of funds left from the appropriation of March 3, 1899, and an allotment of $5,000 from the emergency act of June 6,

1900, 184,753.8 cubic yards of material was removed during the fiscal year ending June 30, 1902, by the U. S. dredge *Comstock*, loaned from the Galveston district. This work restored the 30-foot depth for a width of 100 feet throughout the center of the channel, and for a width of 200 feet a depth of 28 feet was obtained, and this draft could be carried throughout the channel at mean low water on June 30, 1902.

In view of the large amount of dredging required in Pensacola Harbor for securing and maintaining the requisite channel depths, it is considered very desirable that a Government dredging plant should be secured. This will be done under the appropriation made by act of June 13, 1902.

The commerce of this port is very large. For the fiscal year ending June 30, 1899, the foreign and coastwise exports were reported as $14,936,084; in 1900, as $14,828,580; in 1901, as $14,710,649, and in 1902, as $15,464,171.

July 1, 1901, balance unexpended	$12,572.59
Amounts appropriated by river and harbor act approved June 13, 1902, $220,000, and alloted from emergency river and harbor act of June 6, 1900, $5,000	225,000.00
	237,572.59
June 30, 1902, amount expended during fiscal year	13,910.80
July 1, 1902, balance unexpended	223,661.79
July 1, 1902, outstanding liabilities	2,428.96
July 1, 1902, balance available	221,232.83

(See Appendix R 9.)

10. Escambia and Conecuh rivers, Florida and Alabama.—These two names apply to one and the same river, which flows through a heavily timbered country in southern Alabama and western Florida into Escambia Bay, an arm of Pensacola Bay. Its timber forms a large part of all that is exported from Pensacola. Originally the river was much obstructed by snags and by marl and sand bars, and a bar at the mouth seriously interfered with navigation.

The project is based upon reports of the examinations and surveys printed in the Annual Report of the Chief of Engineers for 1879, pages 843–852, and provides for the improvement of the river from its mouth to Indian Creek, Alabama, an estimated distance of 293 miles, by the removal of snags, logs, and overhanging trees; by excavating rock shoals; by works of contraction and shore protection, and by dredging a channel through the bar at the mouth.

The amount expended to June 30, 1902, was $99,000, and has kept the river fairly free from snags, besides opening and reopening the bar at the mouth from time to time.

No work was done during the past fiscal year.

The commerce of this stream is mainly timber, lumber, and saw logs. It is reported as being valued at about 60 per cent of the timber export trade of Pensacola.

July 1, 1901, balance unexpended	$59.01
Amount appropriated by river and harbor act approved June 13, 1902	5,000.00
	5,059.01
June 30, 1902, amount expended during fiscal year	59.01
July 1, 1902, balance unexpended	5,000.00

(See Appendix R 10.)

11. Alabama River, Alabama.—This river, from Wetumka (on the Coosa River which, 11 miles below, joins the Tallapoosa River to form the Alabama proper) to its junction with the Tombigbee, forms a 323-mile link in a waterway 815 miles long, from Oostenaula and Coosawattee rivers, Georgia, to the Gulf of Mexico.

This river was originally so obstructed by logs, snags, and overhanging trees, and shoals, many with depths of but 2.5 feet, that navigation was practicable at low stages only by day.

The project as amended in 1891 contemplates a low-water channel 6 feet in depth, to be secured by means of the removal of snags and overhanging trees, contraction works, blasting, dredging, and shore protection.

The estimate submitted in 1891 amounted to $386,251, and was based upon an assumption that $100,000 should be provided annually. Ten thousand dollars annually was the estimate for maintenance, including snagging.

The amount expended to June 30, 1902, was $392,713.03.

The maximum draft that could be carried through the channel at low water June 30, 1902, was 3 feet.

The commerce of this stream is important, consisting principally of cotton, cotton seed, fertilizer, grain, lumber, shingles, naval stores, staves, and a large quantity of miscellaneous freight of all descriptions, estimated for the past fiscal year as 114,087 tons, valued at $8,060,000.

July 1, 1901, balance unexpended	$27,482.77
Amount appropriated by river and harbor act approved June 13, 1902	20,000.00
	47,482.77
June 30, 1902, amount expended during fiscal year	25,195.80
July 1, 1902, balance unexpended	22,286.97
July 1, 1902, outstanding liabilities	1,017.88
July 1, 1902, balance available	21,269.09

(See Appendix R 11.)

12. Coosa, Oostenaula, and Coosawattee rivers, Georgia and Alabama.—The Coosa is formed by the Oostenaula and Etowah rivers, which have their sources in northern Georgia. The town of Rome, Ga., is situated at their junction. The Etowah is not navigable. The Oostenaula is formed by the junction of Coosawattee and Connesauga rivers, 60 miles northwest of Rome. The Oostenaula and its tributary, the Coosawattee, are navigable for light-draft boats the year round from Rome to Carters Landing, a distance of 105 miles. These rivers have been improved by works of contraction and channel excavation. The river and harbor act of June 13, 1902, authorizes the expenditure of $10,000 on improvement of the Oostenaula and Coosawattee rivers.

The Coosa River has always been navigable for light-draft boats from Rome, Ga., to Greensport, Ala., an estimated distance of 162 miles. This part of the river is of such a character as to make its improvement by works of contraction and channel excavation entirely practicable.

From Greensport, Ala., to Wetumka, Ala., a distance of 142 miles, the improvement requires the building of locks and dams in conjunction with works of contraction and channel excavation.

(a) Coosa River between Rome, Ga., and East Tennessee, Virginia and Georgia Railroad bridge, and Oostenaula and Coosawattee rivers.—

The present project for Coosa River provides for the removal of the lesser rock shoals, and sand and gravel bars by excavation and by works of contraction, and for the construction of eight locks and dams to overcome the more serious obstructions. This project was based upon recommendations contained in the reports of the various examinations and surveys printed in the Annual Reports of the Chief of Engineers for 1871, 1872, 1875, 1878, 1881, and 1890.

Locks 1, 2, and 3, Coosa River, commenced prior to 1890, have been long since completed. They are situated, respectively, 0.68 mile, 3.86 miles, and 5.24 miles below Greensport, Ala., and have available lengths of 175 feet and widths of 40 feet.

The modification of the project for Coosa River, as the result of the survey of 1889 (reported upon in 1890), contemplates locks below No. 3, 52 feet by 280 feet in the clear, with 6 feet on the miter sills, and intermediate channel improvement to a depth of 4 feet.

Lock No. 4 (on the Coosa, 25.89 miles below Greensport), of the larger dimensions above mentioned, together with its appurtenances, has been under construction, with desultory appropriation, since 1886. It is still incomplete.

To June 30, 1902, there has been expended on the Coosa $983,923.14, accomplishing the lock construction above mentioned, building the four dams, and effecting channel improvement as far down as Lock No. 4, to which point navigation is now carried on, except in lowest stages, interruptions then occurring a short distance above Lock No. 4.

Owing to the small balance available, nothing was done during the past fiscal year except maintenance of existing structures and care of the large amount of plant on hand.

On June 30, 1902, the maximum draft that could be carried at low water between Rome, Ga., and Lock No. 4 was 2 feet.

The commerce of this portion of the Coosa consists principally of cotton, cotton seed, fertilizer, timber, lumber, staves, grain, and miscellaneous articles.

July 1, 1901, balance unexpended	$1,240.57
Amount appropriated by river and harbor act approved June 13, 1902, including amount transferred from lower division	45,000.00
	46,240.57
June 30, 1902, amount expended during fiscal year	141.31
July 1, 1902, balance unexpended	46,099.26
July 1, 1902, outstanding liabilities	1,099.26
July 1, 1902, balance available	45,000.00

(*b*) *Coosa River between Wetumka and East Tennessee, Virginia and Georgia Railroad bridge.*—On account of the numerous rapids this section has never been navigable.

The project adopted, as the result of the survey of 1889 (reported upon in 1890), contemplates slack-water navigation, and involves, besides channel excavation, the construction of 23 locks and dams.

The locks are to be 280 feet by 52 feet in the clear, with 6 feet on the miter sills, and the channel between locks to have a least depth of 4 feet.

The lowest lock of the series, known as No. 31, has been completed except as to gates, but the dam has not been built.

There is no navigation possible upon this section of the river.

There was expended to June 30, 1902, $385,423.62, which has resulted in the above-described lock, channel excavation between this

lock and the next above, and the obtaining of data and preparation of plans for other locks and dams.

No work has been done during the past fiscal year except care and preservation of public property pertaining to the improvement and making necessary repairs to houses and grounds in the vicinity of Lock 31.

July 1, 1901, balance unexpended	$26,238.78
Amount transferred to upper division, act of June 13, 1902	10,000.00
	16,238.78
June 30, 1902, amount expended during fiscal year	1,662.40
July 1, 1902, balance unexpended	14,576.38
July 1, 1902, outstanding liabilities	149.79
July 1, 1902, balance available	14,426.59

(See Appendix R 12.)

13. Operating and care of canals and other works of navigation on Coosa River, Georgia and Alabama.—The expenses of operating and care of Locks Nos. 1, 2, and 3, and the improved channel as far down as Dam No. 4, during the fiscal year ending June 30, 1902, amounting to $42,106.40 exclusive of outstanding liabilities ($3,821.23) on June 30, 1902, has been paid from the permanent indefinite appropriation provided by section 4 of the act of July 5, 1884.

(See Appendix R 13.)

14. Removing sunken vessels or craft obstructing or endangering navigation.—The local officer was charged with the duty of removing the wreck of the steamer *Mascot* from the Flint River, and it was removed during the past fiscal year, at a cost of $250.

(See Appendix R 14.)

SURVEY REQUIRED BY THE RIVER AND HARBOR ACT APPROVED MARCH 3, 1899.

The local officer was charged with the duty of making survey required by the river and harbor act approved March 3, 1899, of Chattahoochee River between West Point and Franklin, Ga., preliminary report on which was transmitted to Congress and printed in House Doc. No. 111, Fifty-sixth Congress, second session, and in the Annual Report of the Chief of Engineers for 1901, page 1793. If possible final report will be submitted in time for transmission to Congress at its next session.

IMPROVEMENT OF RIVERS AND HARBORS IN WESTERN ALABAMA AND EASTERN MISSISSIPPI.

This district was in the charge of Maj. Wm. T. Rossell, Corps of Engineers, to September 9, 1901, and of Capt. Spencer Cosby, Corps of Engineers, since that date. Division Engineer, Col. Peter C. Hains, Corps of Engineers, to July 24, 1901, and Lieut. Col. H. M. Adams, Corps of Engineers, since that date.

1. Mobile Harbor, Alabama.—This channel originally had minimum depths of 5½ feet through Choctaw Pass, and 8 feet through Dog River bar.

The improvement of the channel of Mobile Harbor has been progressive. Between 1826, the date of the first appropriation for this work, and 1857 a channel 10 feet deep was dredged through the shoals

in Mobile Bay up to the city of Mobile. Between 1870 and 1876 this depth was increased to 13 feet, the channel being dredged to a width of 300 feet through Choctaw Pass, and 200 feet through Dog River bar.

In 1880 a project for a channel 17 feet deep and 200 feet wide was adopted, and appropriations between 1878 and 1886 were applied to the formation of a channel of these dimensions.

In the river and harbor act of August 11, 1888, a project for securing a channel 23 feet deep was adopted, this project being modified by the river and harbor act of September 19, 1890, so as to provide for the formation of a channel 23 feet deep, and with a top width of 280 feet from the Gulf of Mexico to the mouth of Chickasaw Creek above the city of Mobile. This channel was completed in 1896, subsequent appropriations, up to and including that made by the sundry civil act of July 1, 1898, having been applied to its maintenance.

The total amount expended on these projects was $3,648,630.68, of which about $115,000 is estimated to have been applied to maintenance.

The existing project for the improvement of Mobile Harbor provides for the formation of a channel 23 feet deep and 100 feet wide at bottom with appropriate slopes, from the entrance of the bay to the mouth of Chickasaw Creek, at an estimated cost of $1,640,000. This project was adopted by the river and harbor act approved March 3, 1899.

The amount expended on work under the existing project up to the close of the fiscal year ending June 30, 1902, is $599,645.39, of which about $2,000 has been applied to maintenance.

During the fiscal years ending June 30, 1900, and June 30, 1901, 7,911,120 cubic yards of material was removed from the channel of Mobile River and Bay under the existing project, in the formation of a channel 23 feet deep, from 40 to 200 feet wide, and with an aggregate length of 26.6 miles. This work was completed on February 2, 1901, and made a 23-foot channel available between the Gulf of Mexico and the city of Mobile.

During the past fiscal year no work of dredging has been done in connection with this improvement, owing to the exhaustion of available funds. Expenditures were applied to the work of maintaining the channel by the removal of sunken logs, snags, and similar obstructions, and to making examinations and surveys.

On June 30, 1902, the minimum low-water depths within the limits of the present project were about 20½ feet.

As the bottom at these points is comparatively soft, the maximum low-water draft that can be carried to Mobile is 21 feet. The average range of tide is about 1¼ feet.

With additional appropriations made available by the river and harbor act approved June 13, 1902, it is proposed to continue operations toward enlarging the existing channel to the prescribed depth and width throughout the limits of the project, to undertake the work of removing deadheads, sunken logs, and other obstructions in Mobile Bay, and to commence the work of deepening and widening the channel through the outer bar near Fort Morgan.

Detailed information with reference to the work accomplished under the existing project is contained in the Annual Report of the Chief of Engineers for 1901, page 1809. The report of the survey upon which the project for Mobile Harbor is based is printed in House Doc. No. 199, Fifty-fourth Congress, first session, and in the Annual Report of the Chief of Engineers for 1896, page 1463. The report of the survey

upon which the project for the improvement of the outer bar near Fort Morgan is based is printed in House Doc. No. 219. Fifty-sixth Congress, second session, and reprinted in the Annual Report of the Chief of Engineers for 1901, page 1854.

The imports and exports, foreign and domestic, for 1901 aggregated 1,616,446 tons; value, $28,482,331.

July 1, 1901, balance unexpended	$4,111.34
Amount appropriated by river and harbor act approved June 13, 1902	300,000.00
	304,111.34
June 30, 1892, amount expended during fiscal year	3,756.73
July 1, 1902, balance unexpended	300,354.61
July 1, 1902, outstanding liabilities	215.00
July 1, 1902, balance available	300,139.61
Amount (estimated) required for completion of existing project	740,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	200,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix S 1.)

2. Black Warrior, Warrior, and Tombigbee rivers, Alabama.—(*a*) *Black Warrior River.*—The name "Black Warrior" is given to that portion of the Warrior River above the city of Tuscaloosa, Ala. The original condition of this river was such as practically to close it to navigation on account of shoals at and above Tuscaloosa.

The original project for the improvement was adopted in 1887, the object being to obtain a channel 6 feet deep at low water all the year round between Tuscaloosa and Daniels Creek, 14½ miles above, by means of five locks and dams, at an estimated cost of $741,670.

During the fiscal year 1896 three locks were completed and opened to navigation. All locks of the system are to be 52 feet wide, 322 feet between hollow quoins, and 285 feet in available length.

The river and harbor act of March 3, 1899, provided for the construction of Lock 4 on this river, at a cost not to exceed $190,500, but it was subsequently found that the lock could not be completed for the amount appropriated. A provision is contained in the river and harbor act approved June 13, 1902, for the transfer of $14,000 from the unexpended balance of the Warrior River appropriations, to be applied to the completion of this lock. The same act extends the upper limit of the improvement to the junction of the Mulberry and Locust forks of the river, 46½ miles above Tuscaloosa, and provides for making a survey for the location of Locks 5 and 6 on the upper part of the Black Warrior River. Seven additional locks will have to be built, as a part of the general scheme, to secure an all-the-year-round 6-foot channel between Mobile, Ala., and the Warrior coal fields.

During the past year contract work on Lock 4 has progressed slowly without intermission. The masonry of the lock is about 84 per cent completed, the abutment is practically finished, and the dam is about 16 per cent completed.

The total amount expended on the improvement to June 30, 1902, was $714,859.16.

The improvement of the Black Warrior River between Tuscaloosa and Daniels Creek is based upon the report of a Board of Engineers,

dated April 2, 1887, published in the Annual Report of the Chief of Engineers for 1887, page 1302.

For commercial statistics see report on "Operating and care of locks and dams on Black Warrior River, Alabama."

A revised estimate of the cost of completing Lock and Dam No. 4 was submitted by the local engineer and transmitted to Congress. It is printed in House Doc. No. 239, Fifty-seventh Congress, first session, and is herewith in Appendix S 2.

(*b*) *Warrior River.*—Originally this river was much obstructed by logs, snags, and overhanging trees, which rendered navigation impossible at low water and dangerous even at high water. The minimum depth of channel was 1 foot and the minimum width 60 feet.

The original project for the improvement, adopted by the river and harbor act approved March 3, 1875, contemplated deepening the channel by jetty construction and the removal of snags and overhanging trees. As appropriations were formerly made for the Warrior and Tombigbee rivers jointly, the amount expended on improvement of the Warrior River prior to the adoption of the present project is not known.

The project adopted by the river and harbor act of March 3, 1899, under which operations are now being carried on, is for the construction of six locks and dams, giving a lift of 60.2 feet, and is to afford a channel of 6 feet depth at low water all the year round. The estimated cost of this work is $1,510,000.

The act above mentioned provided for the construction of three of these locks and dams at a cost not exceeding $660,000. Contract for building Locks and Dams 4, 5, and 6 was entered into in February, 1900, work to be completed December 31, 1901, but the time of completion has since been extended to December 31, 1903. On June 30, 1902, the building of Lock 4 was 55 per cent completed; that of Lock 5, about 71 per cent completed, and that of Lock 6, about 83 per cent completed. The gates, valves, and special irons had been built at the Tuscaloosa shops and delivered at the lock sites. The valves and irons are being built into place by the contractors, and it is proposed to erect the gates by hired labor during the present working season. The total amount expended on this work to June 30, 1902, was $372,907.33, none of which has been applied to work of maintenance.

An account of this work may be found in the Annual Report of the Chief of Engineers for 1897, page 1679. The report of the survey upon which the present project is based is printed in the Annual Report of the Chief of Engineers for 1890, page 1719.

The river and harbor act approved June 13, 1902, provides for the construction of Locks and Dams Nos. 1, 2 and 3, on this river at a cost not to exceed $874,000. Under this provision, contract will be entered into for the building of these three locks and dams. A revised estimate for completing these locks and dams was submitted by the local officer and transmitted to Congress. It is printed in House Doc. No. 165, Fifty-seventh Congress, first session, and is herewith in Appendix S 3.

All commercial statistics obtainable on this stream are included in those reported on "Operating and care of locks and dams on Black Warrior River, Alabama."

July 1, 1901, balance unexpended	$608,649.63
Amount appropriated by river and harbor act approved June 13, 1902	374,000.00
	982,649.63
June 30, 1902, amount expended during fiscal year	242,166.12
July 1, 1902, balance unexpended	740,483.51
July 1, 1902, outstanding liabilities	82,500.00
July 1, 1902, balance available	657,983.51
July 1, 1902, amount covered by uncompleted contracts	212,411.17
Amount (estimated) required for completion of existing project	500,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	400,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(c) *Tombigbee River from the mouth to Demopolis, Ala.*—The original condition of the navigable channel of this portion of the river was such as to permit of steamboat navigation during high-water stages only, lasting about six or eight months of the year. The minimum width of the channel was about 100 feet, and the minimum depth 2 feet.

The original project for the improvement of this stream, as adopted in 1871, contemplated the removal of snags and other obstructions in the channel of the river, and the widening and deepening of the existing channel through various shoals, at an estimated cost of $21,500. The project adopted in 1879 was to afford a channel of navigable width and 4 feet deep at ordinary low water from the mouth to Demopolis by the removal of snags, logs, and overhanging trees, and the improvement of the worst bars.

The amount expended on the improvement of this section of the Tombigbee River under previous projects can not be given, as joint appropriations for the Warrior and Tombigbee rivers were made from 1875 to 1882, while between 1884 and 1888 the lower division of the river for which appropriations were made extended from Vienna, Ala., to the mouth.

The present project for the improvement of this section of the Tombigbee River was adopted by the river and harbor act approved September 19, 1890, and was slightly modified in 1897. It provides for securing a channel 6 feet deep at low water by the removal of logs, snags, and trees, and the construction of bank revetment and locks and dams. The improvement proposes the construction of three locks, each 52 feet wide, 322 feet long (285 feet available length), and with a total lift of 31 feet. The cost of this project, as originally estimated, was $508,898, which was modified in 1897, after $330,000 had been appropriated, so that the estimated additional cost of completion at that time was $600,000.

The amount expended on work under the existing project to the close of the fiscal year ending June 30, 1902, was $383,980.81, of which about $50,000 was applied to maintenance.

This entire section of the river has been repeatedly cleared of snags, dredging has been done at the worst bars, and the channel made navigable for steamboats on a 3½-foot rise above ordinary low water.

Lock No. 1, at McGrews Shoals, has been completed with the exception of about 50 feet of the floor, one-third of the filling behind the

bank wall, and the installation of the gates and valves. The dam is yet to be constructed, and considerable work is necessary to protect the banks of the river above the lock.

During the fiscal year ending June 30, 1901, an allotment of $4,000 from the emergency river and harbor act approved June 6, 1900, was expended in the removal of the most dangerous obstructions which had accumulated in this section of the river. During the past fiscal year expenditures have been confined to the care and preservation of public property.

The river and harbor act approved June 13, 1902, appropriated $20,000 for the maintenance of the Tombigbee River between the mouth and Demopolis, of which sum $4,000 may, in the discretion of the Secretary of War, be expended between Columbus and Walkers Bridge, Miss. It is proposed to apply this appropriation, after deducting the $4,000 available for the upper river, to the work of removing obstructions from the stream, to the work of restoring the channel in this section of the river, and to the repair of plant as far as the funds available will permit.

Detailed accounts of this improvement are contained in the Annual Reports of the Chief of Engineers for 1896, page 1437; 1897, page 1685; and 1900, page 2202. The report of the survey upon which the existing project is based is printed in the Annual Report of the Chief of Engineers for 1890, page 1716.

Commerce on the river in 1901 aggregated 220,415 tons, valued at $3,896,450.

July 1, 1901, balance unexpended	$557.47
Amount appropriated by river and harbor act approved June 13, 1902	20,000.00
	20,557.47
June 30, 1902, amount expended during fiscal year	557.47
July 1, 1902, balance unexpended	20,000.00

(*d*) *Tombigbee River from Demopolis, Ala., to Columbus, Miss.*— The original condition of this section of the river was such as to admit of navigation only during high-water stages. The channel was obstructed by shoals, snags, logs, and overhanging trees, the minimum depth of water being 1 foot and the minimum width of channel 70 feet.

The improvement of the Tombigbee River between Demopolis and Columbus was commenced under the project of 1871, which contemplated the improvement of this stream by the removal of snags and other obstructions in the river and the widening and deepening of existing channels through various bars. In 1879 this project was modified so as to provide for the formation of a channel of navigable width and 3 feet deep at low water from Demopolis to Columbus.

The earlier appropriations being made for the Warrior and Tombigbee rivers jointly, the exact amount expended on the original projects for this improvement can not be stated.

The present project for the improvement of this section of the Tombigbee River provides for securing a channel 6 feet deep at low water from Demopolis to Columbus, a distance of 156 miles, by snagging, tree cutting, bank revetment, bar improvement, and the construction of locks and dams, at a cost originally estimated at $779,400. In 1897 the construction of locks and dams was estimated to cost $2,000,000. This project was adopted by the river and harbor act of September 19,

1890, but no provision has yet been made by Congress for commencing the work of lock and dam construction. The fall of the river from Demopolis to Columbus is about 108 feet.

The total amount expended on work under the existing project up to the close of the fiscal year ending June 30, 1902, is $147,456.89, of which about $47,000 has been applied to maintenance. This expenditure has resulted in the formation of a high-water channel within the limits of the project, navigable for light-draft boats on a 2-foot rise above mean low water, and in the maintenance of this portion of the improvement.

During the past fiscal year expenditures have been confined to the preservation and care of public property.

With available funds it is proposed to maintain the existing improvement, as the construction of locks and dams has not yet been authorized by Congress.

COMMERCIAL STATISTICS.

The commerce on the river for the calendar year 1901 amounted to 45,055 tons; value, $780,320.

July 1, 1901, balance unexpended	$16,107.27
June 30, 1902, amount expended during fiscal year	3,564.16
July 1, 1902, balance unexpended	12,543.11
July 1, 1902, outstanding liabilities	1,620.00
July 1, 1902, balance available	10,923.11

(*e*) *Tombigbee River from Fulton to Columbus, Miss.*—The original condition of this section of the river was such that navigation was impossible except during very high water. The channel was much obstructed by logs, snags, and overhanging trees; it had a minimum depth of 1 foot at low water and a minimum width of 50 feet.

The original and existing project for the improvement of the river above Columbus was adopted in 1873, and provided for obtaining a good high-water channel by the removal of obstructions, at an estimated cost of $35,000. This project was completed in 1882, at a cost of $27,293.65, since which time operations have been directed toward maintaining the improvement. The first specific appropriation for the portion of the river between Fulton and Columbus was made in 1892, this money, together with subsequent appropriations, being applied to the maintenance of a high-water channel. This portion of the river has been freed of snags and overhanging trees, and has been placed in a condition to permit of the passage of large rafts of logs and timber during high water. The total amount expended on this project up to the close of the fiscal year ending June 30, 1902, is $50,293.65, of which the sum of $23,000 has been applied to maintenance.

During the past fiscal year no work has been accomplished in connection with this improvement, the expenditures being confined to the preservation and care of public property.

It is proposed to apply a portion of the $4,000 made available in the river and harbor act approved June 13, 1902, in the appropriation for the improvement of the Tombigbee River from the mouth to Demopolis, to maintaining the channel between Fulton and Columbus by removing snags, logs, and other obstructions which have accumulated in the stream after high-water stages.

COMMERCIAL STATISTICS.

During the calendar year 1901 37,500 tons of timber was transported on the river; value, $225,000.

July 1, 1901, balance unexpended	$210.88
June 30, 1902, amount expended during fiscal year	210.88

(*f*) *Tombigbee River from Walkers Bridge to Fulton, Miss.*—The original condition of this section of the river was such that navigation for small rafts was possible only during high water, and, owing to the obstructions in the stream, even such navigation was troublesome and dangerous. The original and existing project for this improvement was adopted in 1888, and provides for securing a good high-water channel by removing logs, snags, and overhanging trees, at an estimated cost of $11,000, and for the maintenance of the same at an annual cost of $1,500. This project was adopted by the river and harbor act approved August 11, 1888, and was completed in 1891, at a cost of $6,517.19. The work accomplished since that date has been for the maintenance of the improvement.

The condition of the river on June 30, 1900, was such that large rafts could be brought down on a 3-foot rise above ordinary low water. Since that date no work has been accomplished in connection with this improvement on account of the exhaustion of available funds, and at present many obstructions exist in the channel which should be removed in order to insure its safety for high-water navigation. Up to the close of the fiscal year ending June 30, 1902, the total amount expended on this improvement was $14,000, of which $7,482.81 has been applied to maintenance.

It is proposed to apply a portion of the $4,000 made available in the river and harbor act approved June 13, 1902, in the appropriation for the improvement of the Tombigbee River from the mouth to Demopolis, to the work of maintaining the channel between Walkers Bridge and Fulton, by removing snags, logs, and other obstructions which have accumulated in the stream since the last work of improvement.

Reports on surveys upon which this project is based are printed in the Annual Reports of the Chief of Engineers for 1882, page 1312, and 1887, page 1226.

July 1, 1901, balance unexpended	$57.51
June 30, 1902, amount expended during fiscal year	57.51

(See Appendixes S 2 and 3.)

3. Operating and care of locks and dams on Black Warrior River, Alabama.—These locks and dams are near Tuscaloosa, Ala., and are known as Locks 1, 2, and 3, Black Warrior River, Alabama. They were finished and opened to commerce in November, 1895, and on July 1, 1896, their operation and care became a charge under the general law of July 5, 1884.

During the fiscal year these locks have been operated and cared for by two lockmen at each lock, under the supervision of a lock-master. In addition to their operation much repair work was done on the locks, including the extension of guard-crib protection above each lock. The total expense during the year for operating and repair was $16,417.87.

The commerce through the locks during the fiscal year ending June

30, 1902, amounted to 625 tons coal, 9,314 tons stone, 1,819 tons sand, 180 tons lock gates, 87 tons logs, 805 tons lumber, and 170 tons general merchandise.

(See Appendix S 4.)

4. Noxubee River, Mississippi.—The original condition of this river was such that navigation was impossible except by small flat boats during four or five months of the year. The minimum width of the river was 60 feet, and the minimum depth of the channel was 1½ feet.

The original project for this improvement was adopted in 1880, and provided a channel for small river steamers during nine months of the year from the mouth of the stream to Macon, Miss., at an estimated cost of $65,245.25. This project was completed in 1889 at a total cost of $47,527.52, and all work done since that time has been toward the preservation of the existing channel. On June 30, 1900, the river was navigable for light-draft boats up to Macon, Miss., the head of navigation, on a rise of 6 to 8 feet.

During the past fiscal year no work has been done in connection with this improvement, as no funds were available therefor. The total amount expended on this project up to the close of the fiscal year ending June 30, 1902, is $62,000, of which $14,472.48 has been applied to maintenance.

It is proposed to apply any future appropriations that may be made for this stream to the work of maintaining the existing high-water channel. The wisdom of doing further work on this river is a question upon which the citizens of the locality are not agreed, petitions having been addressed to the Secretary of War both for and against the discontinuance of the improvement and the abandonment of the river as a commercial highway. No appropriation has been made for this stream since 1896. The report of the survey upon which the existing project is based is printed in the Annual Report of the Chief of Engineers for 1880, page 1092. An account of the improvement is contained in the Annual Report of the Chief of Engineers for 1897, page 1691.

(See Appendix S 5.)

5. Pascagoula River and Horn Island Harbor, Mississippi.—Originally the anchorage at Horn Island Harbor had a depth of 21 feet except over the shoals known as the "Bulkhead" and the "Neck," where the depths ranged between 17.5 and 19.7 feet. The channel in Dog River for a distance of 3 miles above its mouth, and in Pascagoula River from the mouth of Dog River as far down as Scranton, Miss., had a depth of 12 feet, except at Dog Island, near Lowery Island, and opposite the mouth of Belle Fontaine Bayou. Below Scranton the depth of the channel, except in a few reaches, was less than 12 feet, these shoals limiting the draft of vessels using the river to 9 or 9½ feet.

The project for improving this portion of the Pascagoula River was adopted by the river and harbor act approved March 3, 1899, and provided for the formation of a channel 12 feet deep from a point in Dog River 3 miles above its mouth down the Pascagoula River to the 12-foot contour in Mississippi Sound, the channel above the railroad bridge at Scranton to be 150 feet wide and the channel below the bridge 300 feet wide. In Horn Island Harbor this project contemplated the formation of a channel 500 feet wide and 20 feet deep through

the shoals existing in the anchorage. By this act the improvement of the lower portion of Pascagoula River was separated from the project for its improvement above the mouth of Dog River.

In July, 1899, a contract was entered into for the execution of all work necessary for the formation of a channel of the proposed dimensions throughout the limits of the project. Work under this contract was commenced in September, 1899, and up to the close of the fiscal year ending June 30, 1901, had resulted in the formation of a channel in Pascagoula River 12 feet deep and 150 feet wide through the shoals at Dog Island, near Lowery Island, and at Belle Fontaine Bayou, and a channel of the same depth and 300 feet wide for a distance of 9,900 feet below the railroad bridge at Scranton. Beyond this point, for a further distance of about 17,500 feet, the channel had been dredged to a depth of 12 feet over a width of 200 feet only, while in Horn Island Harbor a channel 400 feet wide and about 4,000 feet long had been dredged through the Bulkhead Shoal. The total amount of material removed from the channel of Pascagoula River under this contract up to June 30, 1901, was 843,044 cubic yards, and from Horn Island Harbor 166,722 cubic yards.

During the past fiscal year work under this contract was continued until February 28, 1902, when operations under the existing 12-foot project were completed. The work of the past year included the widening of 17,500 feet of the Pascagoula River channel from 200 to 300 feet, the redredging of shoal points at various places in Pascagoula River, the widening of the 20-foot channel through the Bulkhead Shoal at Horn Island from 400 feet to 500 feet throughout the length of 4,000 feet, and the dredging of a channel 20 feet deep, 500 feet wide, and about 1,250 feet long through the shoal in Horn Island Harbor known as the "Neck." The total quantities of material excavated during the fiscal year are 66,665 cubic yards from Horn Island Harbor and 322,209 cubic yards from the Pascagoula River, making the totals removed under the contract at these two localities, 233,387 cubic yards and 1,165,153 cubic yards, respectively. The removal of this material resulted in the formation of uninterrupted channels of the specified widths and depths throughout the limits of the project.

The total amount expended on work under the present project up to the close of the fiscal year ending June 30, 1902, was $304,364.36, no portion of which has been applied to maintenance.

The river and harbor act approved June 13, 1902, appropriated $25,000 for the improvement of Pascagoula River, with a view to securing a 17-foot channel from 3 miles above the mouth of Dog River to the 17-foot contour in Mississippi Sound, 150 feet wide above the railroad bridge and 300 feet wide below, and authorized additional contracts, to be paid for as appropriations may from time to time be made by law, not exceeding in the aggregate $125,000. With the appropriations thus authorized it is proposed to commence work toward the formation of the 17-foot channel in such a manner as to afford the greatest benefit to shipping interests.

The report of the survey of Pascagoula River upon which the existing project is based is printed in House Doc. No. 211, Fifty-fourth Congress, second session, and reprinted in the Annual Report of the Chief of Engineers for 1897, page 1718. The report of the survey of Horn Island Harbor is printed in House Doc. No. 200, Fifty-fourth Congress, second session, and reprinted in the Annual Report

of the Chief of Engineers for 1897, page 1716. An account of this improvement is contained in the Annual Reports of the Chief of Engineers for 1899 and 1900, pages 1718 and 2211, respectively.

On June 30, 1902, the maximum low-water draft that could be carried between Mississippi Sound and the lumber mills at Moss Point was 12 feet. The average range of tide at this locality is about 1¼ feet.

COMMERCIAL STATISTICS.

The commerce on the river for the calendar year 1901 amounted to 647,700 tons; value $3,593,270.

July 1, 1901, balance unexpended	$128,892.61
Amount appropriated by river and harbor act approved June 13, 1902	25,000.00
	153,892.61
June 30, 1902, amount expended during fiscal year	115,656.97
July 1, 1902, balance unexpended	38,235.64
Amount (estimated) required for completion of existing project	750,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	100,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix S 6.)

6. Pascagoula, Chickasahay, and Leaf rivers, Mississippi.—(*a*) *Pascagoula River (above the mouth of Dog River).*—Before this improvement was commenced the channel through the bar at the mouth of the river had a least depth of 3 feet, while inside the mouth for a distance of 10 miles upstream the river was navigable for vessels of 6½ feet draft. Thence up to the junction of the Leaf and Chickasahay rivers navigation was impossible except during high water. The minimum width of the latter portion of the river was 60 feet and the minimum depth 1 foot, the channel being, in addition, very much obstructed by snags and logs. Appropriations were made in 1827, 1828, and 1852, but there is no record of the work accomplished in those years.

The first extended project for this improvement was adopted in 1880, and contemplated securing a channel 7 feet deep and 200 feet wide across the bar at the mouth of the river, together with the improvement of the stream above the mouth throughout its whole length by the removal of snags and overhanging trees. This project was practically completed in 1884, the total amount expended on the improvement up to the time of the adoption of the existing project being $89,500. In 1886 the existing project was adopted, which provides for securing a channel of navigable width and 12 feet deep between Moss Point and Mississippi Sound, and for the maintenance of the existing channel above Moss Point.

Under this project a depth of 9 feet across the entrance bar was first obtained; subsequently a channel was dredged from Moss Point to the mouth, 12 feet deep and 80 feet wide, a dam was built across the western channel of the river at Lowery Island, the channel across the bar at the mouth of the river was partially completed to a depth of 12 feet, and the upper reaches of the river were cleared of obstructions from time to time, work being suspended on February 13, 1897. The river and harbor act of March 3, 1899, made a separate appropriation for the improvement of the Pascagoula River from a point in the Dog River 3 miles above its junction with the Pascagoula River to the

12-foot contour in Mississippi Sound, no provision having been made in that act for the continuation of the improvement of Pascagoula River above the mouth of Dog River. The total amount expended on work under the existing project up to the close of the fiscal year ending June 30, 1902, was $111,000, of which the sum of $10,000 is estimated to have been applied to maintenance.

On the completion of operations in 1897 a maximum draft of 9½ feet could be carried up to Moss Point, while the river above this point had been cleared of obstructions so as to allow vessels of 6½ feet draft to navigate up as far as Cedar Creek, a distance of 55 miles, throughout the year.

The river and harbor act approved June 13, 1902, appropriated $8,500 for maintaining the improvement of Pascagoula River and its tributaries, the Chickasahay and Leaf rivers, Mississippi. It is proposed to apply the sum of $4,000 from this appropriation to the work of maintaining the existing channel in Pascagoula River.

The report of the survey upon which the present project is based is printed in the Annual Report of the Chief of Engineers for 1886, page 1215. An account of the improvement is contained in the Annual Report of the Chief of Engineers for 1897, page 1692.

For commercial statistics see "Pascagoula River and Horn Island Harbor, Mississippi."

(*b*) *Chickasahay River.*—The original condition of this river was such that it was navigable only for small rafts during high water, and even navigation of this character was troublesome and dangerous. The minimum width of the channel was 50 feet and the minimum depth 6 inches, the river being badly obstructed with logs and snags. The original project for this improvement was adopted by the river and harbor act of September 19, 1890, and provided for obtaining a high-water channel from the mouth of the river up to Shubuta, Miss., a distance of 130 miles, by the removal of obstructions and overhanging trees. The river and harbor act of June 3, 1896, modified this project by limiting the improvement to that part of the river between the mouth and a point near Bucatunna, Miss., about 75 miles. The project further provided for the maintenance of the improved channel. The project as modified was completed in the latter part of 1896, at a cost of $12,399.73, subsequent operations being for maintenance of the improvement.

On June 30, 1900, the condition of the river was such as to permit of its navigation by light-draft boats up to the railroad bridge near Bucatunna on a 4-foot rise above ordinary low water. Operations in connection with this improvement were suspended in September, 1899, owing to the exhaustion of available funds, since which time a number of obstructions have accumulated in the channel.

During the past fiscal year expenditures have been confined to the preservation and care of public property. The total amount expended on work under the existing project up to the close of the fiscal year ending June 30, 1902, was $19,500, of which $7,100.27 has been applied to maintenance.

The river and harbor act approved June 13, 1902, appropriated $8,500 for maintaining the improvement of Pascagoula River and its tributaries, the Chickasahay and Leaf rivers, Mississippi. It is proposed to apply the sum of $2,250 from this appropriation to the work of maintaining the existing high-water channel in Chickasahay River.

COMMERCIAL STATISTICS.

The combined commerce of the Chickasahay and Leaf rivers for the calendar year 1901 amounted to 294,750 tons; value, $1,900,000. It is estimated that 60 per cent of the tonnage was carried on the Chickasahay and 40 per cent on the Leaf.

(*c*) *Leaf River.*—Originally it was impracticable to navigate this river on account of the snags, logs, and overhanging trees obstructing the channel. The minimum width of the stream was 100 feet and the minimum depth 2½ feet. The original project for this improvement was adopted in 1890, its purpose being to afford a channel for high-water navigation from Bowie Creek to the mouth of the river, a distance of 75 miles, by the removal of obstructions and overhanging trees. This project was completed in 1897, at a cost of $11,019.04, since which time expenditures have been in the direction of maintaining the improvement. On June 30, 1900, the condition of the river was such as to permit of its navigation by light-draft boats and rafts of logs and timber on a slight rise above low water.

During the past fiscal year no work has been done in the way of removing obstructions, as no funds were available therefor; since the suspension of operations in 1899 numerous obstructions have accumulated in the channel. The total amount expended on work under this project up to the close of the fiscal year ending June 30, 1902, was $17,500, of which the sum of $6,262.46 has been applied to maintenance.

The river and harbor act approved June 13, 1902, appropriated $8,500 for maintaining the improvement of Pascagoula River and its tributaries, the Chickasahay and Leaf rivers, Mississippi. It is proposed to apply the sum of $2,250 from this appropriation to the work of maintaining the existing high-water channel in Leaf River.

The report of the survey upon which the present project is based is contained in the Annual Report of the Chief of Engineers for 1899, page 1462, and an account of the improvement is contained in the Annual Reports of the Chief of Engineers for 1896 and 1900, pages 1452 and 2215, respectively.

For commercial statistics see report on Chickasahay River.

July 1, 1901, balance unexpended	$638.15
Amount appropriated by river and harbor act approved June 30, 1902	8,500.00
	9,138.15
June 30, 1902, amount expended during fiscal year	638.15
July 1, 1902, balance unexpended	8,500.00

(See Appendixes S 7–9.)

7. *Improving harbor at Biloxi, Miss.*—This channel originally had a minimum depth of 4 feet. The original project for its improvement was adopted in 1882 and contemplated the formation of a channel through Deer Island Flats to connect Biloxi Bay with the Back Bay of Biloxi, at an estimated cost of $35,000. The channel thus proposed was to have a depth of 8 feet at low water, with a width sufficient for navigation.

In 1884 this project was changed so as to provide for deepening the channel from Mississippi Sound to the wharves at Biloxi from the existing depth of 4 or 4½ feet to 8 feet, the estimated cost of this work being $55,000. The work of dredging under the project was commenced in September, 1887, and the project was completed in 1892, at a cost of $34,148.64. The balance of funds available, to the extent of

$10,233.63, was subsequently applied to the work of removing shoals which had formed in the lower part of the dredged cut, and to widening the channel to a slight extent. At the last examination, made in August, 1893, the channel was found to have a minimum width of 160 feet and a minimum depth of 9 feet. No work has been in progress in connection with this improvement since August, 1893.

The total amount expended on work in connection with the existing project to the close of the fiscal year ending June 30, 1902, was $44,382.27. In January, 1896, the balance of $617.73 was redeposited to the credit of the appropriation.

The river and harbor act approved June 13, 1902, appropriated $10,000 for the work of continuing the improvement of Biloxi Harbor, Mississippi. It is proposed to apply these funds to the work of deepening or widening the channel at Biloxi, after an examination of this locality is completed, in such a manner as to afford the greatest benefit to the navigation interests of the port.

The report of the preliminary examination of Biloxi Harbor is printed in the Annual Report of the Chief of Engineers for 1882, page 1322. An account of the improvement is contained in the Annual Report of the Chief of Engineers for 1893, page 1772.

July 1, 1901, balance unexpended	$617.73
Amount appropriated by river and harbor act approved June 13, 1902	10,000.00
July 1, 1902, balance unexpended	10,617.73

(See Appendix S 10.)

8. Channel from Gulfport to Ship Island Harbor, Mississippi.—Originally no channel existed between Ship Island Harbor and Gulfport, Miss. The depths on the site of the channel now in progress of formation ranged from 19 feet to 8½ feet, and the depths over the site of the proposed anchorage basin varied from 8½ feet to 2½ feet.

The existing project for this improvement was adopted by the river and harbor act of March 3, 1899, which authorized the Secretary of War to enter into a contract or contracts to dredge a channel 300 feet wide and 19 feet deep at mean low water from the anchorage basin at Ship Island Harbor, on the Gulf of Mexico, to Gulfport, Miss., and to construct at the end of this channel next the shore an anchorage basin of similar depth and not less than 2,640 feet by 1,320 feet in area. This act also authorized the Secretary of War to contract for the maintenance of this channel and anchorage basin for a term of five years after their completion, for the sum of $10,000 annually.

This work was first advertised in 1899, but no bids for its performance were then received. It was again advertised in January, 1901, and one bid was received, which was accepted. Under this proposal a contract was entered into by the terms of which it was agreed by the contractor to dredge the channel and anchorage basin as called for by the project for the sum of $150,000, to be completed within two years from the date of commencement. Under the terms of this contract the maintenance of the channel and basin was required for the term of five years from the date of their completion, for the sum of $10,000 annually.

Work under this contract was commenced on April 16, 1901, and has been continuously in progress since that time.

On June 30, 1902, the depths in the dredged cuts in the channel and anchorage basin varied from 14 to 21 feet, the maximum low-water draft available being 18 feet.

The average range of tide at this locality is about 1¾ feet.

The sundry civil act approved June 28, 1902, appropriated $150,000 for the payment of contract work at Gulfport in accordance with the provision in the river and harbor act approved March 3, 1899, authorizing the execution of this work. These funds will be held until the completion of the channel and anchorage basin of the projected dimensions.

Under date of May 20, 1901, an allotment of $1,000 from the permanent indefinite appropriation made by section 4 of the river and harbor act of July 5, 1884, was made for this work, and under date of July 24, 1901, a similar allotment of $9,485.04 was made. Under these allotments the work has been surveyed and laid out, and the dumping of the material dredged under the contract has been supervised by inspectors appointed by this office. The expenditure to June 30, 1902, was $5,522.27.

A report of a survey of the channel from Ship Island Harbor to Gulfport, Miss., is printed in House Doc. No. 120, Fifty-fifth Congress, third session, and is reprinted in the Annual Report of the Chief of Engineers for 1899, page 1787.

COMMERCIAL STATISTICS.

During the calendar year 1901, 87,700 tons of timber, valued at $877,000, was carried through the channel.

July 1, 1901, balance unexpended	[a] $448.98
Amount allotted from appropriation made by act of July 5, 1884	[a] 9,485.04
Amount appropriated by sundry civil act approved June 28, 1902	150,000.00
	159,934.02
June 30, 1902, amount expended during fiscal year	[a] 4,971.25
July 1, 1902, balance unexpended	154,962.77
July 1, 1902, outstanding liabilities	[a] 540.00
July 1, 1902, balance available	154,422.77
July 1, 1902, amount covered by uncompleted contracts	150,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902, for maintenance of improvement	10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix S 11.)

9. Ship Island Pass, Mississippi.—Originally the depth of water over the outer bar at Ship Island Pass was only sufficient for vessels drawing about 20 or 21 feet. The original and existing project for the improvement of this locality was adopted in the river and harbor act approved March 3, 1899, and provides for the formation of a 26-foot channel through this bar at an estimated cost of $40,000.

Work under this project was commenced in November, 1899, and continued until March, 1900, when the project was completed, a navigable channel 4,000 feet long and 26 feet deep having been dredged through the bar at Ship Island Pass.

The amount expended on work under the existing project to the close of the fiscal year ending June 30, 1902, is $39,695.88, the balance

[a] Permanent indefinite appropriation.

of $304.12 from the appropriation of $40,000, made by the river and harbor act of 1899, having been redeposited to the credit of the appropriation on June 26, 1901.

During the past fiscal year no work has been done in connection with this improvement, and no liabilities have been incurred, the small balance of $11.76 available on July 1, 1901, having been expended in the payment of incidental liabilities incurred during the previous fiscal year.

An account of this improvement is contained in the Annual Report of the Chief of Engineers for 1900, page 2216, and the report of the survey upon which the project is based is printed in House Doc. No. 120, Fifty-fifth Congress, third session, and reprinted in the Annual Report of the Chief of Engineers for 1899, page 1787.

July 1, 1901, balance unexpended	$11.76
June 30, 1902, amount expended during fiscal year	11.76

10. Pearl River below Rockport, Miss.—This work was originally reported under the heading "Pearl River below Jackson." An act of Congress approved April 21, 1900, authorized the construction of a fixed bridge across Pearl River at Rockport, thus virtually making Rockport, 246 miles from the mouth of the river and 67 miles below Jackson, the head of navigation for this section of the stream.

Prior to improvement, the condition of this river was such that it was not navigable except during high-water stages, and even then navigation was difficult and dangerous.

The original project for this improvement was adopted in 1880, and provided for a channel of navigable width and 5 feet deep at low water by the removal of snags and sunken trees from the river bed and of overhanging trees from the banks, at an estimated cost of $95,940. This project having been found to be impracticable, a modified project was adopted in 1885, which provided for securing a 2-foot channel at low water throughout this section of the river, at an estimated cost of $145,940.

The total amount expended under this project and its modification up to the close of the fiscal year ending June 30, 1902, was $155,125, of which about $50,000 was applied to maintenance. The condition of the river on June 30, 1901, was such as to permit of its navigation at mean low water from the mouth to Monticello, a distance of 212 miles, by boats of 3 feet draft. From Monticello to Rockport the river is navigable only on a 6 or 7 foot rise above ordinary low water.

Since the suspension of work, on January 15, 1900, the channel has been injured to some extent by snags, logs, and other obstructions lodging in the stream. During the past fiscal year no work has been done in connection with this improvement, expenditures being confined to the care and preservation of public property.

It is proposed to apply the appropriation of $7,000, made available by the river and harbor act of June 13, 1902, to the work of maintaining the existing improvement by the removal of the worst of the obstructions that have accumulated in the channel of this section of the river.

An account of the improvement is contained in the Annual Reports of the Chief of Engineers for 1897, page 1698, and for 1900, page 2218.

COMMERCIAL STATISTICS.

The commerce on the river for the calendar year 1901 amounted to about 193,000 tons; approximate value, $1,010,000.

July 1, 1901, balance unexpended	$648.60
Amount appropriated by river and harbor act approved June 13, 1902	7,000.00
	7,648.60
June 30, 1902, amount expended during fiscal year	648.60
July 1, 1902, balance unexpended	7,000.00

(See Appendix S 12.)

11. Pearl River between Edinburg and Jackson, Miss.—(*a*) *Between Carthage and Jackson.*—The original condition of this section of the river was such that navigation was impossible except during high-water stages, and even then it was difficult and dangerous. The minimum width of the river was 100 feet, the minimum width of the channel 40 feet, and the minimum depth in the channel was about 1 foot.

The original project for this improvement, which was adopted in 1879, contemplated obtaining a clear channel of navigable width and 5 feet deep at low water between Jackson and Carthage, a distance of 105 miles, at an estimated cost of $21,000. In 1886 this project was modified so as to reduce the proposed depth of the channel to be obtained to 2 feet, this being considered sufficient for the needs of navigation, and at the same time the estimate of cost was increased $29,000.

The amount expended on work under the existing project with its modification up to the close of the fiscal year ending June 30, 1902, was $38,550, of which the sum of $12,535.02 was applied to maintaining the improvement. Owing to the insufficiency of funds, no work has been done during the past fiscal year in connection with this improvement, other than caring for public property.

Work under the project was completed in 1893, at a total cost of $26,014.98. On June 30, 1900, a 2-foot channel within the limits of the improvement had been obtained and preserved in accordance with the project. Some obstructions have subsequently accumulated in the river, but the stream is still navigable for light-draft boats on a slight rise above mean low water. It is proposed to apply a part of the appropriation of $3,000, made available by the river and harbor act approved June 13, 1902, for improving Pearl River between Edinburg and Jackson, Miss., to the work of maintaining the existing 2-foot channel between Carthage and Jackson, by the removal of such obstructions as may have lodged in the channel since the suspension of the last operations of improvement.

An account of this work is contained in the Annual Reports of the Chief of Engineers for 1897, page 1700, and for 1900, page 2220.

(*b*) *Between Edinburg and Carthage.*—The original condition of this portion of the river was such that navigation at low water was impossible, while during high stages it was difficult and dangerous. The minimum width of the channel was 30 feet and the minimum depth of water about 3 inches.

The original project for this work was adopted in 1884, and provided for a high-water channel from Edinburg to Carthage, a distance of 25 miles, during six or eight months of the year, at an estimated cost of $13,464, and for maintenance of this channel at an annual cost

of $500. Work under this project was completed in 1890, at a cost of $5,857.08, subsequent work being for the purpose of maintenance.

The total amount expended on the work under the existing project up to the close of the fiscal year ending June 30, 1902, was $17,250, of which $11,392.92 was applied to maintenance. On June 30, 1900, the high-water channel had been fairly maintained, although the river was somewhat obstructed by logs and snags, funds appropriated in 1899 having been insufficient to remove the accumulation of the previous two years.

During the past fiscal year no work has been done in this section of the river, no funds being available for such operations, and no expenditures were incurred.

It is proposed to apply a portion of the appropriation of $3,000, made available by the river and harbor act approved June 13, 1902, for improving Pearl River between Edinburg and Jackson to the removal of obstructions which have lodged in the navigable channel of the river between Edinburg and Carthage since the suspension of work in 1899.

An account of this improvement is contained in the Annual Reports of the Chief of Engineers for 1897, page 1702, and for 1900, page 2221.

July 1, 1901, balance unexpended	$127.75
June 30, 1902, amount expended during fiscal year	127.75

(See Appendixes S 13 and 14.)

IMPROVEMENT OF HOMOCHITTO RIVER, MISSISSIPPI, AND OF RIVERS AND HARBORS IN SOUTHERN LOUISIANA AND EASTERN TEXAS.

This district was in the temporary charge of Lieut. E. M. Adams, Corps of Engineers, to October 6, 1901, and in the charge of Lieut. Col. H. M. Adams, Corps of Engineers, since that date, with Lieutenant Adams under his immediate orders to December 13, 1901, and Lieut. Paul Stanley Bond, Corps of Engineers, since March 19, 1902.

1. Homochitto River, Mississippi.—About 8 miles above Fort Adams, Miss., the Homochitto enters the Mississippi River. For the first 3 miles it is called the "Narrows," and for a distance of 12 miles farther it takes the name of "Old River." A preliminary examination in 1896 showed that the Narrows had a depth of 5 feet at low water and a width of 150 feet, except for about 1 mile, where it is very narrow and shoal. This part of the river was obstructed by snags and trees. Old River was about 1,000 feet wide, 2 feet deep over the shoalest places at low water, and clear of obstructions. Above Old River the Homochitto had a navigable depth of 8 feet and a width of 150 feet for a distance of 45 miles, but was thickly obstructed by snags, logs, and overhanging trees.

The act of March 3, 1899, appropriated $16,000 for removing obstructions between the mouth of the river and the Yazoo and Mississippi Valley Railroad, a distance of about 60 miles, and a project was approved April 18, 1899, covering this work.

Work under this project was commenced November 27, 1899, and continued until August 13, 1900. The channel was cleared for 18 miles from the mouth to a width varying from 60 to 200 feet.

The amount expended up to June 30, 1902, was $15,478.40.

The improvement is not permanent; snags and logs accumulate in that portion which has been improved, and 36 miles of channel remains to be cleared to complete the project of 1899.

COMMERCIAL STATISTICS.

The commerce carried by boats over the Homochitto River from January 1 to December 31, 1901, consisted of 800 tons, valued at $13,600. Two steamers, with an aggregate tonnage of 223 tons, were engaged in the trade.

July 1, 1901, balance unexpended	$584.28
Amount appropriated by river and harbor act approved June 13, 1902	2,000.00
	2,584.28
June 30, 1902, amount expended during fiscal year	62.68
July 1, 1902, balance unexpended	2,521.60

(See Appendix T 1.)

2. Bogue Chitto, Chefuncte River, Bogue Falia, Tickfaw River and tributaries, Amite River, and Bayou Manchac, Louisiana.—(*a*) *Bogue Chitto.*—[This work was in the charge of Maj. Wm. T. Rossell, Corps of Engineers, until September 9, 1901, and of Capt. Spencer Cosby, Corps of Engineers, since that date.] The original condition of this stream rendered navigation impossible except during very high water, the channel of the river being obstructed by shoals and bars at and near its mouth, and by snags, logs, and overhanging trees throughout its extent. The minimum width of the channel was 80 feet, and the minimum depth 3 feet. The present project was adopted in 1890, and provided for securing and maintaining a channe. 3 feet deep from the mouth up to Alford's bridge, near Summit, Miss., a distance of about 190 miles, by closing the west mouth of the river and several runout bayous, and by removing obstructions and overhanging trees, at an estimated cost of $55,000. The improvement has never been carried farther up this stream than Cross River, 80 miles above the mouth, as the appropriations have been small and portions of the expenditures have been made for the purpose of maintaining the earlier improvement.

Total amount expended on work under the existing project up to the close of the fiscal year ending June 30, 1902, is $25,000, of which $10,000 is estimated to have been applied to maintenance.

On June 30, 1900, the condition of the improvement was such that the river could be navigated from the mouth up to Cross River by light-draft boats. Since that time the channel has been injured by the accumulation of logs and snags.

The river and harbor act approved June 13, 1902, made the following provision for continuing the improvement of Bogue Chitto:

Improving Bogue Chitto, Chefuncte River, Bogue Falia, Tickfaw River and tributaries, Amite River, and Bayou Manchac, Louisiana, $9,500.

The report of the survey upon which the present project is based is printed in the Annual Report of the Chief of Engineers for 1889, page 1465, and an account of the improvement is printed in the Annual Reports of the Chief of Engineers for 1897, page 1703, and for 1900, page 2222.

COMMERCIAL STATISTICS FOR THE CALENDAR YEARS ENDING DECEMBER 31, 1900 AND 1901.

[Approximate.]

Articles.	1900.		1901.	
	Tons.	Value.	Tons.	Value.
Logs and timber	52,180	$331,080	30,000	$180,000

(*b*) *Chefuncte River and Bogue Falia.*—Prior to improvement: *Chefuncte River*—a bar, on which depth of water was 4½ feet, obstructed the mouth of the river; from the mouth up to a point of junction with Bogue Falia, 10 miles above, the river was from 300 to 800 feet wide and 15 feet deep, navigable for steamers and sailing vessels, but obstructed by snags and overhanging trees; above this point, not navigable. *Bogue Falia*—navigable for small steamers from point of junction with Chefuncte up to Grants Landing, 4 miles above, for sailing vessels drawing 5 feet to Covington, 2 miles farther, but obstructed by snags and overhanging trees; beyond Covington, not navigable.

The original project, adopted in 1880, provided for dredging through the bar at the mouth of the Chefuncte River and for removal of all obstructions between the mouth of the river and Covington, on Bogue Falia; estimated cost, $5,460. This project was modified in 1884 to provide for building a breakwater to protect the channel across the bar; estimated cost, $1,500. The work of maintenance was commenced in 1892 under project approved August 10, 1892.

Under the projects described the work of improvement and maintenance has been carried on since 1880. The breakwater was constructed in 1884.

Amount expended up to June 30, 1902, $10,469.27, of which $3,969.27 was for maintenance. On that date there existed, from Lake Pontchartrain to Covington, a channel sufficient for the commerce of the locality. During the fiscal year ending June 30, 1902, no work was done. The improvement is not permanent, as obstructions continue to form.

Comparative statement of receipts and shipments for ten years.

Year ending May 31 –	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
1893	30,284		19,770
1894	242,164	212,180	
1895	49,778		192,686
1896	67,680	17,902	
1897	110,034	42,354	
1898	99,505		10,529
1899	97,789		1,716
Calendar year 1899	156,500	58,711	
Calendar year 1900	86,856		69,644
Calendar year 1901	92,874	6,018	

(*c*) *Tickfaw River and its tributaries.*—Prior to improvement these streams—the Tickfaw, Blood, Natalbany, and Ponchatoula—offered a 9-foot channel, navigable for steamers and schooners for an aggregate length of 38 miles; the channel was obstructed by snags, logs, and overhanging trees.

The original project, adopted in 1881, provided for removal of snags, logs, and similar obstructions so far as appropriations would permit; estimated cost, $10,230. The work of maintenance was commenced in 1892, under project approved August 10, 1892. Under these projects the work has been carried on since 1881. In 1896 it became necessary to remove the water hyacinths from the mouth of the Tickfaw, and in 1899 to clear away a bar which had formed in the same locality. About 30 miles of the river and tributaries has been improved.

Amount expended up to June 30, 1902, was $11,989.81, of which

$3,989.81 was for maintenance. On that date the streams were in fair condition, the channel being available for vessels drawing 6 feet.

During the fiscal year ending June 30, 1902, no work was done in the improvement of these streams. The improvement is not permanent; snags, logs, and hyacinths continue to accumulate.

Comparative statement of receipts and shipments for ten years.

Year ending May 31—	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
1893	13,994	2,587	
1894	10,003	26,009	
1895	23,384		16,619
1896	72,851	49,467	
1897	58,115		14,736
1898	75,579	17,464	
1899	52,961		22,618
Calendar year 1899	79,300	26,339	
Calendar year 1900	55,540		23,760
Calendar year 1901	56,464	924	

(*d*) *Amite River and Bayou Manchac.*—Prior to improvement the Amite River was navigable for small steamers for a distance of 45 miles from its mouth; Bayou Manchac for a distance of about 10 miles. Both streams were obstructed by snags and overhanging trees.

The original project, adopted in 1880, provided for clearing the obstructions from the Amite above Bayou Manchac, so as to obtain a channel 5 feet in depth at low water; estimated cost, $23,760. In 1883 this project was modified so as to extend the work from Bayou Manchac to Lake Maurepas at an additional cost of $8,000. In 1888 Congress added to the project the removal of obstructions in Bayou Manchac.

The work of maintenance was commenced in 1892, under project approved August 13, 1892.

Under the projects described the work has been carried on since 1880; Amite River was improved for 42 miles from its mouth and the bar at its mouth removed; Bayou Manchac was improved for a distance of 10 miles from its mouth, and a turning basin made at the upper limit of improvement.

Amount expended up to June 30, 1902, was $33,687.63, of which $8,887.63 was for maintenance. On June 30, 1901, the channel was available for vessels drawing 5 feet.

During the fiscal year ending June 30, 1902, no work was done toward the improvement of these streams. The improvement is not permanent, as snags accumulate.

Comparative statement of receipts and shipments for ten years.

Year ending May 31—	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
1893	22,099	3,569	
1894	157,902	135,803	
1895	42,983		114,919
1896	55,103	12,120	
1897	49,509		5,594
1898	54,749	5,240	
1899	60,305	5,556	
Calendar year 1899	59,850		455
Calendar year 1900	25,400		34,450
Calendar year 1901	69,818	44,418	

July 1, 1901, balance unexpended	$190.79
Amount appropriated by river and harbor act approved June 13, 1902	9,500.00
	9,690.79
June 30, 1902, amount expended during fiscal year	37.50
July 1, 1902, balance unexpended	9,653.29

(See Appendixes S 15 and T 2–4.)

3. Closing crevasse in Pass a Loutre, Mississippi River.—Pass a Loutre is one of the three outlets of the Mississippi River. The crevasse forms an outlet from Pass a Loutre into an arm of the Gulf known as Garden Island Bay, and was caused by the wearing away of the south bank of that pass at a locality 1¾ miles below Head of Passes.

The ditch where the crevasse first broke was 3 feet wide in 1872, and gradually increased from year to year. In January, 1891, the crevasse began to widen rapidly, but could not be checked on account of high water in the river. In July, 1891, it was 860 feet wide and 25 feet deep. Several attempts were made about this time by the estate of James B. Eads to close the crevasse, but it seemed a hopeless task, and was abandoned. On November 18, 1896, the crevasse was 2,230 feet wide, and on February 26, 1897, Congress appropriated $250,000 for the closure.

The project approved July 10, 1897, provided for building a dam 6,650 feet long, in two sections, 1,900 and 4,750 feet long, respectively, forming an angle of 112° at a distance of 3,000 feet below the mouth of the crevasse, the dam to be constructed of Wakefield sheet piling backed with a double row of piles securely braced and bolted to stringers and the sheet piling, using a third row of brace piles where the depth of water exceeded 20 feet.

Under this project a contract for the work was approved December 10, 1897. Work was carried on from December 14, 1897, to January 27, 1898, and from August 5, 1898, to November 13, 1898. On the last-named date the work was considered completed, and was accepted. At that time it seemed that the closure would prove a permanent success, notwithstanding the high stage of the river. A severe storm arose that night, and on November 14 the dam gave way in two localities and 170 feet of it washed out. From time to time since then the break in the dam has widened. On June 30, 1902, it was 919 feet, 210 feet being lost within the past year.

On February 17, 1898, Congress allotted $10,000 from this appropriation for the expenses of a survey and report by a Board of engineer officers upon the practicability of securing a channel of adequate width and of 35 feet depth at mean low water of the Gulf of Mexico throughout Southwest Pass, Mississippi River. The survey was completed in 1898 and report submitted on January 7, 1899. This report is printed in House Doc. No. 142, Fifty-fifth Congress, third session, and in the Annual Report of the Chief of Engineers for 1899 as Appendix U 19.

The amount expended from this appropriation up to June 30, 1902, was $228,995.08, of which $6,727.36 was for the survey of Southwest Pass and $1,000, reserved March 6, 1902, for expenses of the Office of the Chief of Engineers.

No work toward closing the crevasse was attempted during the past year, the amount available being insufficient for the purpose.

July 1, 1901, balance unexpended	$22,004.92
June 30, 1902, amount expended during fiscal year	[a] 1,000.00
July 1, 1902, balance unexpended	21,004.92

(See Appendix T 5.)

4. Outlet of the Mississippi River.—The river and harbor act of March 3, 1899, as amended by the act of June 6, 1900, appropriated $200,000 for constructing a sill across Pass a Loutre and for constructing and operating one or more dredges for improving the outlet of the Mississippi River, and authorized continuing contracts to be made for these purposes not exceeding $300,000 additional. It also provided for the appointment of a Board of Engineers to prepare a project for a channel 35 feet in depth throught Southwest Pass, and appropriated $20,000 for expenses of the Board. The sundry civil act of June 6, 1900, appropriated $300,000 additional to cover the authorized continuing contracts.

On September 23, 1899, and July 2, 1900, the Secretary of War approved projects allotting, of the total of $500,000 appropriated, aggregate amounts of $175,000 for sill construction and $325,000 for construction and operation of one dredge

A contract for the construction of a mattress sill, weighted with stone, across the head of Pass a Loutre was entered into March 31, 1900. Work on the sill was commenced July 1, 1900, and completed December 31, 1900, at a total cost of $174,914.06. This sill has prevented the enlargement of Pass a Loutre, and has increased the current across head of South Pass.

A dredge for work at this locality is being built under the direction of Capt. J. C. Sanford, Corps of Engineers, and contracts amounting to $286,605 are now in force for its construction, the time for completion being February 28, 1903.

Counting all material gotten out especially for this dredge and the amount of shop work done, the boat as a whole was about 33.8 per cent completed at the close of the past fiscal year.

The sum of $179,610.41 has been expended on this work by the New Orleans, La., office up to June 30, 1902, of which $174,914.06 was for the sill and $3,696.35 for expenses connected with preparation of plans, etc., for a dredge.

The Board of Engineers appointed under provisions of the act of March 3, 1899, submitted a report and project for Southwest Pass channel on January 11, 1900. The report was transmitted to Congress and is printed in House Doc. No. 329, Fifty-sixth Congress, first session, and also on pages 2287–2302, annual report for 1900.

The project of the Board contemplates securing a channel 1,000 feet wide and 35 feet deep at mean low water throughout the Southwest Pass, by dredging; the construction of two jetties to maintain the channel; the construction of sills across Cubits Gap, The Jump, and Baptiste Collets Canal; the closing of all minor outlets below the forts; the construction of an additional dredge, together with other necessary plant, such as tugboats, barges, tracks, buildings, etc., and the purchase of land at the shore ends of the jetties; the whole estimated to cost $6,000,000, and $150,000 additional per annum for maintenance.

[a] Withdrawn for expenses Office Chief of Engineers.

The river and harbor act of June 13, 1902, adopted this project of January 11, 1900, appropriated $750,000, and authorized continuing contracts to be made to the amount of $2,750,000 additional toward the prosecution of the project, at the same time authorizing the Secretary of War, in his discretion, to modify the plans described in the report of the Board. No expenditures had been made from this appropriation to June 30, 1902.

In the project mentioned the Board stated that—

> If no serious unforeseen difficulties are met with and the funds are supplied in sufficient quantity, a practicable ship channel through Southwest Pass should be open to commerce at the end of three years from the time when the funds become available, and the entire work should be completed in five years. It is assumed that the whole amount of the estimate will be appropriated in four equal annual appropriations.

If the project of the Board is to be carried out without interruption to the progress of the work, the sum of $1,500,000 will be required for the fiscal year ending June 30, 1904.

See reports on closing crevasse in Pass a Loutre, and maintenance of South Pass channel, Mississippi River, in connection with this work.

Commercial statistics.—For commercial statistics for the port of New Orleans, see report on maintenance of South Pass channel, Mississippi River.

OUTLET MISSISSIPPI RIVER.

July 1, 1901, balance unexpended	$321,915.72
June 30, 1902, amount expended during fiscal year	[a] 1,526.13
July 1, 1902, balance unexpended	320,389.59

SOUTHWEST PASS, MISSISSIPPI RIVER.

Amount appropriated by river and harbor act approved June 13, 1902.	$750,000.00
July 1, 1902, balance unexpended	750,000.00
Amount (estimated) required for completion of existing project	5,250,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	1,500,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix T 6.)

5. Maintenance of South Pass channel, Mississippi River.—The act of Congress of March 3, 1875, amended by acts of June 19, 1878, and March 3, 1879, made provision for the construction, by James B. Eads or his representatives, of jetties and other works in South Pass, to secure and maintain a channel 26 feet in depth through the pass, and through the jetties at the mouth of the pass a channel "26 feet in depth, not less than 200 feet in width at the bottom, and having through it a central depth of 30 feet without regard to width." A contract was made for the maintenance of such a channel for a period of twenty years.

On January 28, 1901, this contract expired, and the work of maintenance is being continued under the provisions of the emergency river and harbor act of June 6, 1900, which provides that at the termination of the contract with the representatives of the estate of James B. Eads, deceased, the Secretary of War shall take charge of and maintain the channel, jetties, and auxiliary works at South Pass, for which a sum

[a] Includes $1,000 allotted to Capt. J. C. Sanford, October 30, 1901.

not to exceed $100,000 per year is appropriated until otherwise provided for by law.

The sum of $25,000 was also appropriated by the sundry civil act of June 6, 1900, for the purpose of altering a dredge or dredges of the Mississippi River Commission so as to make the same available for use in South Pass in case any unusual obstruction to navigation occurred.

The river and harbor act approved June 13, 1902, also contained the following provisions for this work, viz:

The Secretary of War is hereby directed to maintain the channel in the South Pass of the Mississippi River with the utmost efficiency, and for that purpose the dredge boat *Beta*, or any other available Government dredge, may be used, and the lands and buildings on either side of the South Pass, or such part thereof as in his discretion may be necessary, may be purchased for the United States from the heirs or legal representatives of James B. Eads, deceased, and for the purposes named herein seventy-five thousand dollars is hereby appropriated in addition to the one hundred thousand dollars annually allowed for maintenance in the act of Congress approved June sixth, nineteen hundred.

The provisions of the act of March third, eighteen hundred and seventy-five, and of the act of August eleventh, eighteen hundred and eighty-eight, with regard to examinations and surveys at South Pass, mouth of the Mississippi River, shall remain in force as fully as though they were herein reenacted in express terms, notwithstanding the termination of the contract with the late James B. Eads and associates.

Under the provisions of the sundry civil act approved June 6, 1900, the dredge *Beta* was transferred to South Pass, and employed in the work of maintaining the channel from February 4 to June 27, 1901. The result of the work was an increase in the depth through Goat Island, Grand Bayou, Upper Base, and Port Eads reaches from 27.4, 27.5, 28 and 28 to 30.3, 29.2, 29.4, and 30.9 feet, respectively, over an aggregate length of 10,800 feet. The U. S. dredge *Sabine* was employed on the work for a short time during the past fiscal year. The *Beta* was retransferred to South Pass in May, 1902, and with an allotment of $10,000 from the emergency river and harbor appropriation of June 6, 1900, dredging has been carried on since May 26, commencing in Port Eads reach. The available depth was 26.4 feet, and after eighty-six hours' dredging it was increased to 31.1 feet. A cut 2,700 feet in length was made, resulting in a channel depth of 31 to 33 feet, generally the latter, with a width of 50 feet for the 30-foot channel. The dredge was at work in this locality at the close of the past fiscal year.

The jetties and auxiliary works were maintained in effective condition, resulting in the utmost efficiency in maintaining a channel of more commercial value than ever before existed through South Pass.

A portion of the plant and material of the Eads estate was purchased for use in repairs and maintenance to jetties and auxiliary works.

The sum of $109,522.07, including $9,447.69 outstanding liabilities that could not be paid until after June 30, was expended on this work during the past fiscal year. The following is a statement of the expenditures from January 29, 1901, to June 30, 1902:

EXPENDITURES.

Maintenance of South Pass Channel, Mississippi River, act of June 6, 1900:	
Fiscal year 1901	$42,101.71
Fiscal year 1902	99,522.07
	141,623.78
Emergencies in river and harbor works, act of June 6, 1900, fiscal year 1902	10,000.00
	151,623.78

Comparative statement of receipts and shipments for three years for the port of New Orleans, La.

Year ending December 31.	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
1899	3,176,740		
1900	2,773,645		403,095
1901	4,213,869	1,440,224	

PERMANENT AND EMERGENCY APPROPRIATIONS.

Amount appropriated by emergency river and harbor act approved June 6, 1900, for fiscal year 1902		$100,000.00
Amount allotted March 24, 1902, from appropriation for emergencies in river and harbor works, act approved June 6, 1900		10,000.00
		110,000.00
June 30, 1902, amount expended during fiscal year	100,074.38	
June 30, 1902, outstanding liabilities	9,447.69	
June 30, 1902, total cost of operations during fiscal year		109,522.07
June 30, 1902, balance reverting to Treasury		477.93

APPROPRIATION FOR ALTERING DREDGES.

July 1, 1901, balance unexpended	$5,901.09
November 20, 1901, deposit as repayment to appropriation	1.53
July 1, 1902, balance unexpended	5,902.62

(See Appendix T 7.)

6. Bayou Lafourche, Louisiana.—Bayou Lafourche is an outlet of the Mississippi River, forming a junction 70 miles above New Orleans. It is about 105 miles long, and flows into the Gulf of Mexico. In its original condition it was obstructed by logs, snags, and overhanging trees. The project of 1879 provided for the removal of such obstructions to improve low-water navigation. Work under this project was carried on until 1885, with appropriations aggregating $30,000.

The project of June 11, 1886, provided for the construction of a lock to connect the bayou with the Mississippi River, and for dredging a channel 75 feet wide and 5 feet deep at mean low water of the Gulf, at an estimated cost of $450,000 and $8,000 annually thereafter for maintenance. Work under this project was confined to dredging to maintain low-water navigation, the appropriations at any one time being insufficient to warrant the commencement of the lock, and the exigencies of commerce not permitting a suspension of the dredging.

The project of 1886 was modified on September 23, 1896, and held in abeyance the construction of the lock, restricting operations to dredging to maintain low-water navigation, at an estimated cost of $25,000 per annum.

The project of July 11, 1895, for the expenditure of $40,000 appropriated August 18, 1894, recommended that $30,000 be reserved for the purchase of a dredge whenever it should become advisable to make such purchase.

Dredging operations under the modified project of 1896 were carried on in 1897 and 1898 from the head of the bayou to about 3 miles below Thibodeaux, improving about 38 miles of channel. This improvement

is not permanent, as sand bars form each year after the subsidence of floods in the Mississippi River.

The project of July 11, 1895, so far as the reservation of $30,000 for purchase of a dredge is concerned, was modified on December 7, 1899, to allow the expenditure of $9,000 of this amount in dredging to maintain flatboat navigation during low water. With these funds and the $7,500 appropriated March 3, 1899, dredging was carried on from August 9, 1899, to January 22, 1900, and a depth of 3 feet during low water was secured from the head of the bayou at Donaldsonville to a point 8 miles below.

The project of July 11, 1895, was further modified on May 11, 1900, to allow the expenditure of funds remaining to the credit of this appropriation in dredging during the low-water season. Dredging was carried on from July 25, 1900, to December 8, 1900, over a distance of 5½ miles, maintaining a channel 60 feet wide and 3 feet deep during low-water season of 1900.

The amount expended on this work up to June 30, 1902, was $251,526.57.

To maintain channel during low-water season of 1901, dredging was done from June 25 to December 30, 1901. The work extended over a stretch of 8 miles, the actual dredging having a length of 4.6 miles.

The conditions existing in the bayou at this time are the same that prevailed on June 30, 1901. Steamboats ply the stream for about eight months of each year, but during the remaining months the commerce is carried by flatboats from the Mississippi River. The width of the bayou at low water is about 60 feet; the navigable depth is 18 inches.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1893	212,476	40,591	
1894	273,686	61,210	
1895	263,607		10,079
1896	229,891		33,716
1897	217,292		12,599
1898	269,398	52,106	
1899	206,516		62,882
Calendar year—			
1899	157,258		49,258
1900	210,315	53,057	
1901	137,357		72,958

July 1, 1901, balance unexpended	$12,200.89
Amount appropriated by river and harbor act approved June 13, 1902	7,500.00
	19,700.89
June 30, 1902, amount expended during fiscal year	11,227.46
July 1, 1902, balance unexpended	8,473.43

(See Appendix T 8.)

7. *Bayou Plaquemine, Grand River, and Pigeon Bayous, Louisiana.*—Prior to 1867 the largest steamboats could pass through Bayou Plaquemine into Grand Lake and other connecting water routes, but at that time the police jury of Iberville Parish closed the bayou by means of a dam, shutting out the waters of the Mississippi. Grand River

and Pigeon Bayous were obstructed by snags, logs, overhanging trees, and sand bars.

The present project is based upon legislation by Congress, according to project and estimate submitted February 11, 1887, and provides for dredging a channel in Bayou Plaquemine 60 feet wide and 6 feet deep from deep water up to the Plaquemine dike, constructing a lock to connect the bayou with the Mississippi River, securing the mouth of the bayou from further caving, and removing obstructions from Grand River and Pigeon Bayous; total estimated cost, $1,708,250.

The project of 1887 was modified on April 10, 1899, to allow for dredging Bayou Plaquemine to a depth of 10 feet and a width of 125 feet.

The protection of the bank of the Mississippi River at the mouth of the bayou was added to the improvement in 1888, and in act of July 13, 1892, the improvement of Grand River and Pigeon Bayous was also incorporated.

The act of June 3, 1896, authorized continuing contracts to be entered into to complete the project of improvement, not to exceed $1,173,250, exclusive of the amounts therein and previously appropriated.

Dredging was carried on in Bayou Plaquemine in 1890, 1891, 1892, and 1894, resulting in securing a channel 6 feet deep and 60 feet wide from the mouth to the railroad bridge.

Work has been carried on under the modified project since October 29, 1899, under contract dated July 15, 1899, for the rectification of Bayou Plaquemine. About four-tenths of the work provided for under the contract has been completed to the required depth of 10 feet and width of 125 feet.

An allotment of $75,000 was made from the appropriation of 1888 for securing the bank of the Mississippi River at the head of the bayou. Five submerged spur dikes placed at intervals of about 900 feet, with intervals protected by revetment, were completed in 1894. These dikes and revetments form a continuous protection 1,400 feet long below the site of the lock and 1,200 feet above, with an interval of 500 feet opposite the lock site left for excavating the necessary channel to the lock. During the past fiscal year two mattresses 400 by 600 feet and 400 by 450 feet, respectively, were sunk in the river and heavily loaded with stone for protection of the banks near the proposed approach to the lock.

In 1893, 1894, and 1897 obstructions were removed from the mouth of Bayou Sorrel and down Grand River through Pigeon Bayou to Grand Lake, a distance of 30 miles. Flat Lake at the mouth of Grand River, was dredged in 1893 and 1897.

Work of dredging and removing obstructions from Grand River was carried on under contract of November 25, 1889, until April 20, 1901. Obstructions were removed from the mouth of Bayou Plaquemine to 2 miles below Bayou Pigeon, and at Bay Natchez, a distance of 30 miles. A survey of Flat Lake and Bay Natchez was made in 1901, and a project for dredging a 50-foot channel 10 feet deep through them was approved April 20, 1901, and modified March 21, 1902. A contract for the work was approved May 1, 1902.

With funds appropriated in 1894 the work of constructing a cofferdam, excavating, and driving a pile foundation for the lock was carried on from 1895 to 1898 and completed.

In 1891 a project for the construction of a lock was submitted, but the funds available were insufficient to warrant its commencement at that time. The Board of Engineer officers appointed to prepare plans and specifications estimated the cost of the lock at $700,000. Revised plans and specifications for the construction of the lock and approaches were approved October 27, 1897, and December 2, 1897, respectively, and a continuing contract for the work was entered into May 28, 1898, and approved June 17, 1898. The work was commenced in August, 1898. On June 30, 1901, the floor and walls of the lock had been completed; miter sills, inlet pipes, and snubbing hooks had been placed. No work under this contract was accomplished during the past fiscal year. The excavation for the approaches, the fill behind walls, construction of connection levees, and erection of gates remain to complete the lock.

A Board of Engineer officers was appointed during the year to consider certain questions relative to this contract. The Board submitted a report on May 22, 1902. The contractors have been asked to submit a price for the extra items.

A contract for the construction of power house and operating machinery for the lock, for $114,000, was entered into November 18, 1899. This work will be commenced when the lock is nearer completion.

Plans for an approach to the lock, to be constructed on the river side at an estimated cost of $114,000, were approved April 20, 1901. The execution of this work will be deferred until the lock is nearer completion.

For the approach to the lock 1.25 acres of land on the north side and 0.31 acre on the south side were purchased August 24, 1900, for $7,500.

A contract was approved May 5, 1902, for the construction of a protection levee from the northeast corner of the lock, to connect with the main levee system in front of the lock. About one-third of the work was completed on June 30, 1902.

The sum of $944,992.03 was expended on these improvements up to June 30, 1902, including $1,000 withdrawn by Office of the Chief Engineer, June 20, 1901, for office expenses.

During high water there is a depth of from 10 to 12 feet in these streams, but during low water there is a depth of only 4 feet in Bay Natchez and 4½ feet in Flat Lake.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1893	78,756		53,119
1894	133,752	54,996	
1895	120,542		13,210
1896	92,379		28,163
1897	57,055		35,324
1898	76,626	19,571	
1899	89,301	12,675	
Calendar year—			
1899	111,750	22,449	
1900	88,543		23,207
1901	263,000	194,457	

July 1, 1901, balance unexpended	$783,277.70
June 30, 1902, amount expended during fiscal year	88,269.73
July 1, 1902, balance unexpended	695,007.97
July 1, 1902, outstanding liabilities	25,894.39
July 1, 1902, balance available	669,113.58
July 1, 1902, amount covered by uncompleted contracts	476,271.19

(See Appendix T 9.)

8. Bayou Courtableau, Louisiana.—Bayou Courtableau lies within the Atchafalaya Basin and is tributary to the Atchafalaya River. Prior to improvement the Atchafalaya River had formed a large deposit of sand, known as Little Devil Bar, at the mouth of Bayou Courtableau. It was proposed by the project of 1880 to improve the bayou below Port Barre by closing some of the run-out bayous, in order to confine the water in the Courtableau, and to wash out the bar with the increased current; after this was accomplished to construct a timber lock and dam to provide slack-water navigation to Washington, La., a distance of 28 miles. The estimated cost of the improvement was $40,000. The project was modified in 1883 to provide for the construction of a masonry instead of a timber lock, increasing the original estimate to $78,500.

With appropriations aggregating $36,200, work was carried on under this project to 1895. The larger run-out bayous were closed with dams, and the increased current was effective in the partial removal of the bar. The dams were broken from time to time, and the bar at the mouth of the bayou formed again. The dams were repaired in 1891 and subsequent years. The construction of a lock has not been commenced, as it is believed that it will not be of benefit until the bar at the mouth is permanently removed.

During the high water of 1896 a large accumulation of logs formed at the neutralization point of the bayou current and the backwater of the Atchafalaya. The raft rapidly increased in size and density until in 1899 it was about 3 miles long and completely obstructed navigation.

Appropriations of $2,500 on June 3, 1896, and $20,000 on March 3, 1899, were made for removal of raft and preventing its re-formation. Work of removing the raft and constructing a boom to prevent entrance of logs from the Atchafalaya was done from October 4, 1899, to June 22, 1900. A channel 60 to 110 feet wide resulted from this work. From March 25 to April 22, 1901, the channel was cleared of logs and drift that had accumulated after the raft was opened.

The sum of $58,567.46 was expended on this improvement up to June 30, 1902, $22,367.46 being for removal of log raft.

During the past fiscal year no work has been done. The bayou is navigable only during high water.

Comparative statement of receipts and shipments for seven years.

Year ending May 31—	Tons.	Decrease in tonnage from previous year.
1890	35,867	
1891	32,618	3,249
1892	20,041	12,577
1893	14,848	5,193
1894	9,195	5,653
1895	4,095	5,100
1896	1,994	2,101

July 1, 1901, balance unexpended	$132.54
July 1, 1902, balance unexpended	132.54

(See Appendix T 10.)

9. Bayou Teche, Louisiana.—Bayou Teche is an important commercial stream of southern Louisiana, and finds its outlet into the Gulf of Mexico through Atchafalaya River. Prior to improvement it had a depth of 8 feet to St. Martinville, La., but navigation was rendered dangerous by numerous obstructions. Above St. Martinville the bayou was navigable by steamboats during high water. The project of 1870 provided for removal of obstructions from the head to the mouth of the bayou. Work under this project was carried on from 1870 to 1886, the stream being cleared of logs, snags, wrecks, overhanging trees, and a number of sand bars. The improvement was not permanent, and other obstructions formed.

The project of 1891 provided for the removal of obstructions between St. Martinville, La., and the mouth of the bayou, a distance of about 80 miles. Work under this project has been carried on since 1891, obstructions being removed as appropriations were made. To June 30, 1902, $80,858.28 had been spent upon this improvement.

No work has been done during the past fiscal year, and none was done during the previous year, sufficient funds not being available.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1893	115,080	50,214	
1894	383,154	268,074	
1895	279,928		103,226
1896	293,685	13,757	
1897	303,029	9,344	
1898	238,783		64,246
1899	286,091	47,308	
Calendar year—			
1899	272,975		13,116
1900	212,109		60,866
1901	335,583	123,474	

July 1, 1901, balance unexpended	$161.72
Amount appropriated by river and harbor act approved June 13, 1902	7,500.00
	7,661.72
June 30, 1902, amount expended during fiscal year	20.00
July 1, 1902, balance unexpended	7,641.72

(See Appendix T 11.)

10. Channel, bay, and passes of Bayou Vermilion, and Mermentau River and tributaries, Louisiana.—(*a*) *Bayou Vermilion.*—Prior to improvement the upper 12 miles of Bayou Vermilion had a depth of only 2 feet, but below this the depth was not less than 5½ feet through the bayou, bay, and passes, with a width from 100 to 400 feet. The channel was obstructed by snags, logs, and overhanging trees.

The original project of 1892 provided for the removal of these obstructions and the erection of guide piles to mark the channel over the bars in Vermilion Bay, and provided for a depth of 5½ feet of water up to the railroad bridge near Lafayette, La., a distance of 50 miles. Estimated cost, $25,000.

With appropriations aggregating $12,500 the removal of obstructions was carried on in 1892, 1893, and 1895, and the stream placed in navigable condition to Broussard's bridge, a distance of 34 miles from the mouth. The guide piles were driven in Vermilion Bay in 1893.

With appropriations aggregating $3,500, made in 1896 and 1899, work was carried on from November 8, 1899, to February 3, 1900, and the stream cleared of obstructions from Abbeville, La., to the railroad bridge. No work has been done since the latter date.

The amount expended up to June 30, 1902, was $16,000. On June 30, 1901, the channel was available to Abbeville for vessels drawing 5½ feet.

No work was done during past fiscal year, no funds being available.

Comparative statement of receipts and shipments for nine years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1894	43,882	8,151	
1895	12,993		30,889
1896	13,022	29	
1897	6,126		6,896
1898	8,862	2,736	
1899	14,969	6,107	
Calendar year—			
1899	7,650		7,319
1900	21,150	13,500	
1901	31,385	10,235	

(*b*) *Mermentau River and tributaries.*—Prior to improvement these streams afforded depths varying from 7 feet to 30 feet; the channel through Grand Lake was 6 feet in depth; at the mouth of the river the depth was 13 feet. The width varied from 70 feet at Viterboville to 350 feet at Lake Arthur. The channel was crooked and obstructed by snags and logs.

The original project, adopted in 1892, provided for the removal of obstructions in the upper river and for building brush dams to remove the mud flat in the lower river. Estimated cost, $23,615.25.

With an appropriation of $7,500, made in 1892, snagging operations were carried on under contract from December 8, 1892, to March 7, 1893, resulting in the improvement of the channel of Mermentau River for 38 miles from the lower end of Lake Arthur.

With appropriations made in 1894 and 1896, aggregating $10,000, work was carried on from December 24, 1897, to April 14, 1898, resulting in the construction of two brush dams, one 2,500 and the other 3,000 feet long, in Mud Lake, and the dredging of a channel 8 feet deep and 50 feet wide across the flats of Mud Lake.

The act of March 3, 1899, appropriated $6,115.25 for completing the improvement. Work done under this appropriation was for maintenance of dredged channel through Mud Lake.

To June 30, 1902, $22,072.03 has been expended on this work, of which $5,465.45 was for maintenance.

No work has been done during the past fiscal year. The brush dams in Mud Lake have been damaged by storms and settlement and do not effectually confine the current to the dredged channel.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1893	16,250		
1894	5,437		10,813
1895	15,955	10,518	
1896	16,459	504	
1897	12,210		4,249
1898	18,650	6,440	
1899	22,236	3,586	
Calendar year—			
1899	2,866		19,370
1900	27,034	24,168	
1901	29,291	2,257	

July 1, 1901, balance unexpended	$1,568.22
Amount appropriated by river and harbor act approved June 13, 1902	11,500.00
	13,068.22
June 30, 1902, amount expended during fiscal year	25.00
July 1, 1902, balance unexpended	13,043.22

(See Appendixes T 12 and 13.)

11. Mouth and passes of Calcasieu River, Louisiana.—Prior to improvement there was a depth of 6½ feet of water over the outer bar at the entrance to Calcasieu Lake. Calcasieu Lake, which is 15 miles long, had a depth of 6 feet; the depth over the inner bars was 3½ feet, and from the upper bar to Lake Charles, La., there was not less than 8 feet of water.

The original project for improvement, adopted in 1872 and modified in 1881, provided for obtaining a channel of navigable width and depth across the inner bars. A channel 8 feet deep and 70 feet wide for a distance of 7,500 feet was dredged through the inner bars in 1874, 1882, and 1883, but in 1885 the channel had shoaled to 3½ feet. In accordance with project approved in 1886, the cut was redredged and a plank revetment on each side of the cut was commenced. The revetment was not finished, and the cut again filled. The amount expended under this project was $199,426.04.

An appropriation of $10,000 made in 1888 for the construction of a revetment, and another of $75,000 made in 1890 for constructing jetties, in accordance with projects submitted in 1886, were held for increase. These amounts were supplemented by an appropriation of $100,000 made in 1892.

The project approved August 13, 1892, under which the present work is being conducted, provides for dredging a channel 50 feet wide and 8 feet deep through the inner bars, revetting this channel to prevent the return of the dredged material; to build parallel jetties of brush and stone at the entrance to the outer pass, and to dredge out between these jetties to secure a depth of 12 feet if necessary. The total estimated cost of these improvements is $600,000.

The revetment was completed August 16, 1893. Dredging at the foot of Calcasieu Lake was carried on in 1894–95 and in 1898. A channel 8 feet deep and 50 feet wide was secured, connecting deep water in Calcasieu Lake and Pass. The construction of the east jetty

at the entrance to the pass was carried on in 1894, 1895, and 1896, and of the west jetty in 1897.

During 1900, with an appropriation of $35,000, the foundation of the west jetty was extended 1,000 feet, making a total length of 3,200 feet.

Amount expended up to June 30, 1902, was $436,001.13, of which $236,575.09 was expended under the present project. On that date there was a depth of but 4½ feet in dredged channel in Calcasieu Lake.

During the fiscal year ending June 30, 1902, no work was done upon these improvements beyond the partial removal of a shell reef in the Calcasieu Lake channel. An examination, completed January 17, 1901, showed that the revetment of the channel in Calcasieu Lake was in a dilapidated condition; that the available depth in this channel was 4½ feet, and that portions of the capping of the jetties had been displaced.

It is proposed by project approved July 3, 1902, to redredge the channel through Calcasieu Lake to a depth of 8 feet, and to repair and extend the east jetty, with funds appropriated June 13, 1902.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1893	207,545		16,665
1894	344,973	137,428	
1895	254,394		90,579
1896	202,775		51,619
1897	141,029		61,746
1898	190,017	48,988	
1899	174,651		15,366
Calendar year—			
1899	16,829		157,822
1900	139,580	122,751	
1901	139,045		535

July 1, 1901, balance unexpended	$545.77
Amount appropriated by river and harbor act approved June 13, 1902	75,000.00
	75,545.77
June 30, 1902, amount expended during fiscal year	46.90
July 1, 1902, balance unexpended	75,498.87
July 1, 1902, amount covered by uncompleted contracts	450.00

(See Appendix T 14.)

12. Johnsons Bayou, Louisiana.—This stream flows into Sabine Lake, Texas. A preliminary survey, made in 1897, showed a minimum channel depth in the bayou of 12 feet, but upon the bar at the mouth there was only 2½ feet of water.

The project approved April 10, 1899, provided for dredging through the bar so as to produce a channel 6 feet in depth and of such width as the appropriation, $2,500, would permit. The dredging was carried on during December, 1899, and the required 6-foot channel, 60 feet wide, was secured.

To June 30, 1902, $2,261.35 has been expended upon the improvement.

No work has been done during the past fiscal year. The stream is navigable for vessels drawing 5 feet.

Comparative statement of receipts and shipments for three years.

Year ending December 31—	Tons.	Increase in tonnage over previous year.
1899	3,163	
1900	3,594	431
1901	4,363	769

July 1, 1901, balance unexpended	$238.65
July 1, 1902, balance unexpended	238.65

(See Appendix T 15.)

13. Removing the water hyacinth from Louisiana waters.—Under the provisions of the sundry civil act of June 4, 1897, a Board of Engineer officers was appointed to investigate the extent of obstruction to navigation in the streams of Florida and Louisiana by the water hyacinth, and determine a method of checking or removing the plants. The Board recommended the construction of boats fitted with crushing appliances, and also the use of log booms as adjuncts to the operation of the steamers. The report of the Board is printed in House Doc. No. 51, Fifty-fifth Congress, third session, and also on page 1615, Annual Report of the Chief of Engineers for 1899.

In accordance with the recommendation of the Board, Congress appropriated by the river and harbor act of March 3, 1899, $25,000 for the construction of a boat, $1,000 for log booms, and $10,000 for operating expenses for removing the plants from Louisiana waters.

A steamboat was purchased and fitted with machinery for raising and crushing the plants. This boat was operated on Bayou Plaquemine from July 9, 1900, to June 1, 1901, when funds for operations became exhausted. Approximately 188,800 square yards of plants was removed. Since that date the cold weather has retarded the growth of the plants, but they will soon be an obstruction to navigation.

A boom with a gate arranged to allow the hyacinths to float out with the tides and to prevent their return was constructed at the mouth of Bayou Teche, Louisiana, in April, 1900. At the present time this boom is out of working order and is not operated.

The total amount expended on this work to June 30, 1902, was $28,515.54.

No work has been done during the past fiscal year. The boat was laid up and cared for by a watchman during the entire year, the amount expended being $549.58.

The act of June 13, 1902, appropriated $50,000 for the removal of the water hyacinth from the navigable waters of the States of Florida, Texas, and Louisiana, and authorized the Secretary of War to use this amount and the unexpended balance of amounts heretofore appropriated for this purpose in the States of Florida and Louisiana in exterminating or removing the plant by any mechanical, chemical, or other means whatsoever.

July 1, 1901, balance unexpended	$8,034.04
Amount appropriated by river and harbor act approved June 13, 1902 ($50,000 for States of Florida, Texas, and Louisiana)	(a)
June 30, 1902, amount expended during fiscal year	549.58
July 1, 1902, balance unexpended	7,484.46
July 1, 1902, outstanding liabilities	53.25
July 1, 1902, balance available	7,431.21

(See Appendix T 16.)

[a] Up to close of fiscal year allotment of funds had not been made.

14. Mouth of Sabine and Neches rivers, Texas.—Both rivers flow into Sabine Lake, Texas. Prior to improvement there was 3½ feet of water on the bar at the mouth of the Sabine River and 3 feet on the bar at the mouth of the Neches. Dredging was carried on at the mouth of the Sabine River in 1880 and 1895, and a channel 60 feet wide and 7 feet deep was secured. At the mouth of the Neches dredging was carried on in 1880, 1889, and 1895, and a channel 50 feet wide, 5 feet deep, and 8,000 feet long was obtained, the funds being exhausted before deep water in Sabine Lake was reached. In 1897 the channel at the mouth of the Sabine River still afforded a depth of 7 feet, while the channel at the mouth of the Neches had shoaled to 4 feet.

The act of March 3, 1899, appropriated $10,000 for improving the mouths of these streams, the appropriation to include the expenses of a reexamination of the proposed channel through Sabine Lake by a Board of Engineer officers.

The Board constituted in compliance with this act submitted, on August 11, 1899, a report on the proposed channel through Sabine Lake, and the report is printed in House Doc. No. 100, Fifty-sixth Congress, first session, and on page 2302, Annual Report of the Chief of Engineers for 1900.

The project approved July 14, 1899, provided for dredging from deep water in the Neches River to deep water in Sabine Lake.

Under this project an 8-foot channel, 7,829 feet long, was dredged from the 7-foot contour in Neches River to the 6-foot contour in Sabine Lake. A part of the appropriation was expended in deepening the channel across the bar at the mouth of the Sabine River.

Up to June 30, 1902, there had been expended upon this work $9,925.29, of which $171.49 was for reexamination of the proposed channel through Sabine Lake.

During the fiscal year ending June 30, 1902, no work was done upon this improvement.

The river and harbor act approved June 13, 1902, contains the following item:

> Improving mouths of Sabine and Neches rivers, Texas, in accordance with House Document Numbered Two hundred and ninety-nine, Fifty-fourth Congress, second session, by connecting the same with Sabine Pass by a channel eight feet deep through Sabine Lake: Continuing improvement, one hundred and twenty-five thousand dollars: *Provided further*, That in the discretion of the Secretary of War he may select a route at or near the west shore of said lake, and said channel may be connected with Port Arthur Canal: *Provided further*, That, in case such connection is made, boats will be allowed to pass through the said canal without payment of any tolls.
>
> In case funds shall be furnished by the citizens of Orange and Beaumont or in any other way to secure a channel along the route herein described of a greater depth than eight feet, the amount herein appropriated may be expended in securing a greater depth than herein designated.

Steps have been taken by the local officer to ascertain the wishes of the citizens of Beaumont and Orange, Tex., and of the owners of the Port Arthur Canal relative to the last three provisions of the act, in order to assist in the preparation of a project.

The report of Maj. James B. Quinn, Corps of Engineers, dated February 3, 1897 (printed in Annual Report of the Chief of Engineers for 1897, p. 1789), upon which the appropriation is based, estimates the cost of an 8-foot channel through Sabine Lake at $150,000. It will require $25,000 additional to complete the work proposed.

COMMERCIAL STATISTICS.

Statistics for the Neches River for the calendar year 1901 could not be obtained. For statistics concerning the Sabine River see report for that work.

July 1, 1901, balance unexpended	$74.71
Amount appropriated by river and harbor act approved June 13, 1902	125,000.00
July 1, 1902, balance unexpended	125,074.71

(See Appendix T 17.)

15. Sabine River, Texas.—This stream is about 470 miles long, and for a greater part of its length forms the boundary between Texas and Louisiana. It flows into the Gulf of Mexico through Sabine Lake. Prior to improvement there was a depth of 3½ feet of water over the bar at the mouth of the river; from the mouth to Orange, Tex., there was ample depth; above Orange the stream was obstructed by logs and snags.

The original project, adopted in 1871 and modified in 1873, provided for deepening the main outlet of the river at a cost of $18,000.

The project of 1889 provided for the closure of two branches forming Old River, to throw all the water into the "Narrows," and for the removal of obstructions. These projects were completed in December, 1890, and a navigable channel provided for vessels drawing 5 feet for a distance of 30 miles above Orange, Tex.

The project of 1892 provided for removing obstructions between Orange, Tex., and Sudduths Bluff, a distance of 50 miles, at an estimated cost of $10,000. This work was completed in 1895.

On June 30, 1899, the dams built in 1890 were in good condition and fulfilling the requirements for which built. The river from the mouth to Morgans Bluff, a distance of 33 miles, was in fairly good condition, but obstructions had formed between Morgans Bluff and Sudduths Bluff, a distance of 31 miles, since 1895.

With $2,000 appropriated in 1896 and a like amount in 1899, work of maintenance was carried on between May 17 and July 13, 1900. The river was cleared of obstructions from Morgans Bluff to within 22.5 miles of Sudduths Bluff. Work ceased on account of lack of funds.

The sum of $52,538.33 was expended up to June 30, 1902, of which $3,838.33 was for maintenance. On that date vessels drawing 5 feet could go 64 miles above the mouth of the river; above Sudduths Bluff, for about 300 miles, vessels of light draft could run during high water.

No work has been done during past fiscal year, sufficient funds not being available.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1893	146,363		
1894	245,657	99,294	
1895	182,738		62,919
1896	271,257	88,519	
1897	245,364		25,893
1898	275,506	30,142	
1899	270,642		4,864
Calendar year—			
1899	407,372	136,730	
1900	a32,148		375,224
1901	459,909	427,761	

a Incomplete. Full statistics could not be obtained.

July 1, 1901, balance unexpended	$161.67
July 1, 1902, balance unexpended	161.67

(See Appendix T 18.)

16. Harbor at Sabine Pass, Tex.—Sabine Pass, about 7 miles long, is the outlet of Sabine Lake into the Gulf of Mexico. Prior to improvement it had a least depth of 25 feet, except over a bar 200 feet long opposite the town of Sabine Pass, over which there was a depth of 18 feet, and a bar 200 feet long opposite Fort Point, where there was a depth of 17 feet. Beyond the shore line, where the pass enters the Gulf of Mexico, there was a bar 3½ miles wide between the interior and exterior 18-foot bottom curves, over which there was a depth of only 6 feet at mean low tide. Under project of 1873 channels 12 and 15 feet deep were dredged through the outer bar in 1878 and 1880; but the improvement was not permanent and the cuts soon filled. The sum of $325,000 was expended under this project.

The project of 1882 proposed to construct parallel jetties of brush and stone, extending from shore across the bar out to deep water in the Gulf, the jetties to be 1,800 feet apart and about 4 miles long; dredging between the jetties to be carried on if necessary to obtain deep water through the pass into the harbor. The estimated cost of the improvements was $3,177,606.50.

The work of jetty building began in 1883 and, with successive appropriations, has been carried on since then.

By the river and harbor act of 1896 contracts were authorized to be entered into for the completion of the project of improvement, the cost being limited to $1,050,000. A contract for this work was approved June 22, 1897, and work was commenced on August 10, 1897. On June 30, 1897, the east jetty had a length of 19,500 feet and the west jetty 14,875 feet. Work under this contract was completed August 6, 1900. The east jetty was extended to a length of 25,100 feet, of which 21.818 feet was capped, 682 feet was riprap, and 2,600 feet was foundation only; and the west jetty was extended to 22,000 feet, of which 15,560 was capped, 1,490 feet was riprap, and 4,950 was foundation only. About 3,000 feet of the previous work was capped. Dredging was done in the channel between jetties in 1897, 1898, and 1899, increasing the depth to 25 feet and the width to 100 feet.

The jetty channel having shoaled, dredging was done from November 28, 1900, to January 3, 1901, with an allotment of $8,000 made from the emergency appropriation of June 6, 1900.

A dredging steamer, the *Sabine*, built under contract dated January 19, 1900, with funds provided by the act of June 4, 1897, was completed and accepted January 14, 1901. Dredging between the jetties since February 9, 1901, has been done by this boat.

Act of March 3, 1899, appropriated $150,000 for straightening, widening, and otherwise improving the harbor by removal of oyster reefs and flats and other material between a point 1,000 feet north of the United States life-saving station and a point opposite the United States light-house. A project covering the proposed work was approved by the Secretary of War March 27, 1899, and a contract for its execution was entered into July 27, 1899. About one-seventh of the work was completed June 30, 1901.

Reports, with estimate, of a preliminary examination of Sabine Pass with a view to widening and straightening the "main ship channel," and increasing the depth, from a point 1,000 feet north of the life-saving station to Sabine Lake, was submitted June 28 and July 14,

1900, and printed in House Doc. No. 70, Fifty-sixth Congress, second session, and in Annual Report of the Chief of Engineers for 1901, page 1915. The sum of $25,000 was appropriated for this improvement by act of June 13, 1902, and project approved July 3, 1902.

A special report on the damage done to the jetties by hurricane of September 8, 1900, was submitted September 25, 1900, and printed as House Doc. No. 152, Fifty-sixth Congress, second session. The estimated cost of repairs is $100,000, and in Annual Report of the Chief of Engineers for 1901, page 1919. A project for the expenditure of that amount from the appropriation made by the act of June 13, 1902, was approved July 3, 1902.

On June 30, 1901, there was a navigable channel of 22 feet at mean low water between the jetties and up to Sabine, excepting at one point, where there was a depth of only 21.8 feet.

To June 30, 1902, $3,036,899.20 had been expended on these improvements under the present project, of which $16,043.60 was for maintenance of the jetty channel since November 28, 1900, and $78,212.25 was for dredging in the harbor under project of 1899.

During the past fiscal year dredging has been done in the harbor opposite Sabine under contract of July 27, 1899. An amount of 602,149 cubic yards of material was removed during the year, making a total of 822,836 cubic yards removed out of approximately 1,421,050. The dredging done has increased the width of the harbor to 500 or more feet over a length of 5,305 feet, and the depth to 25 feet at mean low water over the locality dredged. The work under contract is about six-tenths completed.

The channel having shoaled, dredging between the jetties was carried on with the dredge *Sabine* from October 28, 1901, to January 15, 1902, with $2,000 allotted from the emergency river and harbor appropriation of June 6, 1900, and from February 17, 1902, to end of fiscal year. The expenses of operation from February 17 to June 13, 1902, were paid from funds advanced by the Kansas City Southern Railroad Company under authority of the Assistant Secretary of War.

Under project approved July 3, 1902, it is proposed to expend $60,000 from the appropriation made by act of June 13, 1902, in repairing the dredge *Sabine* and in dredging between the jetties to secure the required depth of 25 feet.

The available depth between the jetties on June 30, 1902, was 22 feet at mean low water.

Additional work should be done toward building the jetties to full height of mean high-water level in order that the full benefits of the improvement may be obtained. It is estimated by the local officer that $1,016,573 will be required to complete the jetties in accordance with the original project.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1893	15,050		22,978
1894	40,966	25,916	
1895	47,691	6,725	
1896	48,886	1,195	
1897	87,632	38,746	
1898	238,400	150,768	
1899	326,982	88,582	
Calendar year—			
1899	326,494		488
1900	217,489		109,005
1901	150,087		67,402

July 1, 1901, balance unexpended	$143,300.54
Amount allotted from appropriation "Emergencies in river and harbor works," act June 6, 1900	2,000.00
Amount appropriated by river and harbor act approved June 13, 1902	185,000.00
	330,300.54
June 30, 1902, amount expended during fiscal year	68,746.77
July 1, 1902, balance unexpended	261,553.77
July 1, 1902, outstanding liabilities	11,798.42
July 1, 1902, balance available	249,755.35
July 1, 1902, amount covered by uncompleted contracts	56,830.57

(See Appendix T 19.)

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN TEXAS.

This district was in the charge of Capt. C. S. Riché, Corps of Engineers, with Lieut. Meriwether L. Walker, Corps of Engineers, under his immediate orders to January 24, 1902. Division Engineer, Col. Amos Stickney, Corps of Engineers, to July 24, 1901, and Lieut. Col. H. M. Adams, Corps of Engineers, since that date.

1. Galveston Harbor, Texas.—Galveston Harbor embraces an anchorage area of over 1,960 acres, of which 1,500 acres has a depth of more than 20 feet and 460 acres has a depth of more than 30 feet. It affords vessels excellent shelter from storms. Waterways connect it with Houston and with Brazos River.

The entrance to this harbor was originally obstructed by two bars, known as the inner and outer. The natural depth on the inner bar was about 9½ feet and on the outer bar about 12 feet. These shallow depths prevented all but the lightest-draft vessels from using the harbor, and necessitated the lighterage of cargoes to the larger vessels anchored in the deep water beyond the outer bar.

Prior to 1874 the projects for improving this harbor related to dredging operations on a small scale, and were only expected to afford temporary relief to navigation.

The project for the permanent improvement of this harbor by jetties was adopted in 1874 and modified in 1880 and 1886. It was expected that upon their completion a least depth of 25 feet would be obtained on the outer bar. (See Annual Report of the Chief of Engineers for 1880, p. 1221 et seq.)

The 1886 project provided for a possible depth of 30 feet, by constructing jetties to a height of 5 feet above mean low tide and extending them to the 30-foot contour in the Gulf and supplementing the action of the tidal scour by dredging. The estimated cost of this revised project was $7,000,000.

The amount expended on the foregoing plans to June 30, 1902, was $8,519,684.42, of which $97,687.85 was for maintenance of the improvement, with an additional sum of $100,000 subscribed by the city of Galveston in 1883. Of this amount $1,478,000 was expended previous to 1886.

This expenditure resulted in a depth of 26 feet at mean low tide on the outer bar, an increase of 14 feet since work began, and a depth of 26 feet at mean low tide on the inner bar, an increase of 16 feet during the same period. This increased depth of water enabled vessels to

load to their full capacity at the Galveston wharves, thereby making the lighterage of cargoes no longer necessary,

At the end of the fiscal year the completed south jetty extended 35,603 feet. On the same date the completed north jetty extended 25,907 feet.

The expenditure during the fiscal year ending June 30, 1902, was for repairing and operating the U. S. dredge *Gen. C. B. Comstock;* in maintaining, strengthening, and widening the channel between the jetties; expenses of resurvey and chart of Galveston Bay, and contingent expenses of the work.

The depth of water on the outer and inner bars remains practically the same as at the end of preceding fiscal year.

Commerce has been greatly benefited by the improvement of this harbor, as shown by the increased size and tonnage of the vessels using the port. The amount of freight handled during the fiscal year was 1,799,977 tons.

The total amount of ocean commerce transported to and from Galveston during the fiscal year was: Cotton and cotton products, 779,518 tons; ore, 66,210 tons; wool, 13,244 tons; grain, 298,326 tons; sugar, 2,900 tons; coal, 107,178 tons; flour, 14,283 tons; lumber and timber, 92,237 tons; cement, 19,781 tons; petroleum, 150,797 tons; fuel oil, 14,064 tons; general merchandise, 227,557 tons; steel rails and fastenings, 11,735 tons; cattle, horses, etc., 2,147 tons.

The hurricane of September 8, 1900, damaged the jetties to a considerable extent, and a report of a Board of Engineers showing the effect of this hurricane on the jetties and the main ship channel, with an estimate for repairing same at a cost of $1,500,000, is contained in House Doc. No. 134, Fifty-sixth Congress, second session, and reprinted in the Annual Report of the Chief of Engineers, page 2018.

The river and harbor act of June 13, 1902, contains the following item:

Improving Galveston Harbor, Texas, by maintaining the entrance to said harbor and toward the restoration of the jetties in accordance with the report submitted in House Document Number One hundred and thirty-four, Fifty-sixth Congress, second session, three hundred and fifty thousand dollars: *Provided*, That a contract or contracts may be entered into by the Secretary of War for such materials and work as may be necessary in prosecuting the project of repairing, restoring, and completing the jetties as recommended in the said report, not to exceed four hundred thousand dollars, exclusive of the amounts herein and heretofore appropriated: *Provided further*, That appropriations heretofore made and unexpended for Galveston Harbor are hereby made available for the above purposes. The Secretary of War is authorized to modify the plan for the south jetty so as to connect and adjust the same with the protection work proposed by the city of Galveston, if found advisable.

July 1, 1901, balance unexpended	$52,433.08
Amount appropriated by river and harbor act approved June 13, 1902	350,000.00
	402,433.08
June 30, 1902, amount expended during fiscal year	43,097.67
July 1, 1902, balance unexpended	359,335.41
July 1, 1902, outstanding liabilities	4,390.08
July 1, 1902, balance available	354,945.33
Amount (estimated) required for completion of existing project	1,150,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	300,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix U 1.)

2. Galveston channel, Texas.—The river and harbor act approved June 13, 1902, provides as follows:

> Improving Galveston Channel in accordance with the report submitted in House Document Numbered Two hundred and sixty-four, Fifty-sixth Congress, second session, one hundred thousand dollars: *Provided*, That a contract or contracts may be entered into by the Secretary of War for such materials and work as may be necessary to prosecute said project, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate two hundred thousand dollars exclusive of the amounts herein appropriated: *Provided further*, That the amounts herein appropriated or authorized shall be expended in obtaining a channel from the outer end of the inner bar to Fifty-first street, thirty feet in depth, and of such width in the respective portions thereof as shall best subserve the interests of commerce.

No work was done up to close of the past fiscal year.

Amount appropriated by river and harbor act approved June 13, 1902.	$100,000.00
July 1, 1902, balance unexpended	100,000.00

Amount (estimated) required for completion of existing project	1,485,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	200,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix U 2.)

3. Deepening the channel from Galveston Harbor to Texas City, Tex.—This channel is designed to afford a channel 100 feet wide at bottom and 25 feet deep, north of Pelican Island, from Galveston Harbor to Texas City, Tex. The natural depth on the line of the proposed channel is from 4 to 8 feet. During 1895 and 1896 a channel 16 feet deep was dredged by the Texas City Terminal Company. No work having been done since then it had at the beginning of present operations shoaled nearly to its natural depth.

Work is now in progress under a contract made in January, 1900.

During the fiscal year there was dredged 967,100 cubic yards of material. The channel has an average depth of 17½ to 23 feet and 120 feet wide at bottom, between Texas City, Tex., and Galveston Harbor, except between stations 8 and 12 + 500, where there has been a refill, giving a channel depth of 13½ feet and 130 feet wide.

No commercial statistics for the fiscal year ending June 30, 1902, could be obtained.

July 1, 1901, balance unexpended	$250,000.00
July 1, 1902, balance unexpended	250,000.00
July 1, 1902, amount covered by uncompleted contract	250,000.00

(See Appendix U 3.)

4. Galveston ship channel and Buffalo Bayou, Texas.—These improvements have heretofore been reported on individually under the headings of "Ship channel in Galveston Bay, Texas," and "Buffalo Bayou, Texas." The river and harbor act of March 3, 1899, combines the work under one item.

The ship channel in Galveston Bay and Buffalo Bayou are two links in the waterway connecting Houston with deep water in Galveston Bay, the other links being the San Jacinto River and the Morgan Canal.

In their natural state these two waterways had a depth of from 4 to 8½ feet. The project adopted for the improvement provided for a channel 100 feet wide and 12 feet deep. Dredging was carried on for

a number of years, furnishing a channel sufficient for the character of vessels heretofore navigating these channels.

In 1892 the Government purchased the Morgan Cut and Canal, 5.43 miles long, from the Buffalo Bayou Ship Channel Company for the sum of $92,316.85.

In 1897 a Board of Engineers submitted a project (see House Doc. No. 99, Fifty-fifth Congress, second session; also Appendix V 9, p. 1515, Annual Report of the Chief of Engineers for 1898) providing for a water channel not less than 25 feet deep and 100 feet wide extending from the mouth of the jetties at the city of Galveston, through the existing ship channel and up Buffalo Bayou to the city of Houston, Tex., and for a harbor at or near Houston of a depth of not less than 25 feet and of a width of 500 feet.

The Board was of the opinion that in the first division of this water route (through Galveston Bay, including the Morgan Canal) the width of channel should be 150 feet, with slopes such as the material may assume, varying from 1 on 2 to 1 on 4. For the second division (from north end of Morgan Canal to Harrisburg) the Board recommended a width of channel limited to 100 feet. In the third division (between Harrisburg and Houston) the removal of at least one bend by a cut-off would be required, and the straightening and widening of others was proposed. It was also proposed to remove the point just below the San Antonio and Aransas Pass bridge, and to widen the channel at the mouth of White Oak Bayou in Houston.

The cost of the work was estimated by the Board as follows:

First division, including construction of two suction dredges	$1,100,000
Second division	900,000
Third division	1,700,000
Administration and contingencies	300,000
Making a total of	4,000,000

The estimated cost of maintenance was $100,000 annually.

The work now under way consists in dredging a channel 70 feet wide and 17 feet deep from deep water in Galveston Harbor, through Galveston Bay and Morgan Cut (division 1), and constructing pile and brush dike from Morgan Cut to Redfish Bar.

The amounts expended on these channels to June 30, 1902 are as follows:

Ship channel in Galveston Bay, including purchase of Morgan Cut and Canal ($92,316.85)	$849,016.85
Buffalo Bayou, Texas	228,750.00
Galveston ship channel and Buffalo Bayou, Texas	224,875.40
Total	1,302,642.25

During the past fiscal year active operations were carried on under contract with Charles Clarke & Co., of Galveston, Tex.

The river and harbor act of June 13, 1902, contained the following item:

Galveston Ship Channel and Buffalo Bayou, Texas: Continuing improvement, three hundred thousand dollars: *Provided*, That a contract or contracts may be entered into by the Secretary of War for such materials and work as may be required to prosecute said improvement, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate seven hundred thousand dollars, exclusive of the amounts herein and heretofore appropriated. The amounts herein appropriated and authorized shall be expended in developing the proposed channel in divisions one and two to a uniform depth: *Provided further*, That not more than one-half of said amounts shall be expended upon division two.

COMMERCIAL STATISTICS.

The only commercial statistics that could be obtained for the fiscal year were those covering freight carried by the Houston Direct Navigation Company, which amounted to 141,130.86 tons, of which 115,021.26 tons was cotton, 1,993 tons was cotton products, 2,409 tons was coal, 2,979 tons was lumber, 3,445 tons was sand, 6,321.6 tons was shell, 222 tons was walnut logs and lumber, 6,353 tons was San Jacinto sand, and 2,387 tons was clay.

For number of vessels and tonnage passing through Morgan Canal, see report on "Operating and care of Morgan Canal." (Appendix U 5.)

July 1, 1901, balance unexpended	$305,852.10
Amount appropriated by river and harbor act approved June 13, 1902.	300,000.00
	605,852.10
June 30, 1902, amount expended during fiscal year	230,727.50
July 1, 1902, balance unexpended	375,124.60
July 1, 1902, outstanding liabilities	31,805.61
July 1, 1902, balance available	343,318.99
July 1, 1902, amount covered by uncompleted contracts	23,859.95
Amount (estimated) required for completion of existing project	3,400,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	500,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix U 4.)

5. Operating and care of Morgan Canal, Texas.—A watchman was stationed at the canal during the past fiscal year. A statement contained in the report of the local engineer officer shows the items of expenditures, which amounted to $363.25.

(See Appendix U 5.)

6. Trinity River, Texas.—The river and harbor act approved June 13, 1902, provides as follows:

Improving Trinity River, Texas, in accordance with the report submitted in House Document Numbered Four hundred and nine, Fifty-sixth Congress, first session, one hundred and twenty-five thousand dollars: *Provided*, That the Secretary of War may enter into a contract or contracts for materials and work to prosecute the project recommended in said report, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate two hundred and seventy-five thousand dollars, exclusive of the amount herein appropriated: *Provided further*, That three hundred and fifty thousand dollars of the amounts herein appropriated and authorized shall be expended to construct locks and dams upon the river between the mouth and section one, in those places where the most serious obstructions exist, and to procure and operate snag boats, and clear the river with the purpose of permitting through navigation over the portion above described; and the sum of fifty thousand dollars of the amount herein appropriated shall be expended for the purpose of securing open channel navigation in section one of said river, and a board of engineers shall be designated by the Secretary of War to examine section one of said river as described in said House document, and report upon the feasibility and advisability of expending the further sum of three hundred and fifty thousand dollars with a view to securing not less than eight months' navigation annually upon the said section one to Dallas.

No work was done up to the close of the past fiscal year. See also report upon this stream under heading for improving Brazos River between Velasco and Richmond.

Amount appropriated by river and harbor act approved June 13, 1902.	$125,000.00
July 1, 1902, balance unexpended	125,000.00

Amount (estimated) required for completion of existing project	4,425,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	250,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix U 6.)

7. Brazos River between Velasco and Richmond, West Galveston Bay channel, Double Bayou, and the mouths of adjacent streams, Texas, including Trinity River and Cedar Bayou.—The river and harbor act approved March 3, 1889, provides as follows:

For the improvement of the Brazos River between Velasco and Richmond, West Galveston Bay Channel, Double Bayou, and the mouths of adjacent streams, sixty-five thousand dollars, out of which said sum a suitable dredge and snagging outfit may be provided to carry on said work and to be used on other approved projects on the Texas coast, including streams emptying into the Gulf of Mexico and bays connected therewith.

Heretofore the projects embraced in this improvement have been independent. (See improving Brazos River, Texas, between Velasco and Richmond, Annual Report of the Chief of Engineers for 1895, p. 1838 et seq.; improving channel of West Galveston Bay, Annual Report of the Chief of Engineers for 1892, p. 1566 et seq., and improving Double Bayou, Annual Report of the Chief of Engineers for 1898, p. 287 et seq.)

The object of this improvement, in part, is to obtain and maintain a navigable channel depth of from 4 to 6 feet across the bars at the mouths of most of the streams and bayous along the Texas coast by dredging and snagging, the plant to be owned and operated by the United States.

The improvement is intended to develop a light-draft inland navigation tributary to Galveston and other Texas harbors which will afford cheap transportation by light-draft steamers and barges to the fertile coast country of Texas.

During the past fiscal year the dredge was practically completed, except necessary furnishing, outfit for operating same, and electric-light wiring. It is expected that by July 30, 1902, the dredge will be entirely completed and in operation.

The amount expended on this improvement to June 30, 1902, was $55,931.59.

The river and harbor act approved June 13, 1902, appropriated $50,000 for this improvement, $30,000 of which may be expended in the purchase of the canal from West Galveston Bay to the mouth of the Brazos River.

No commercial statistics for the fiscal year ending June 30, 1902, could be obtained.

July 1, 1901, balance unexpended	$63,470.68
Amount appropriated by river and harbor act approved June 13, 1902	50,000.00
	113,470.68
June 30, 1902, amount expended during fiscal year	54,402.27
July 1, 1902, balance unexpended	59,068.41
July 1, 1902, outstanding liabilities	6,899.57
July 1, 1902, balance available	52,168.84

(*a*) *Trinity River.*—The improvement of this stream has been limited to that portion lying between the mouth and Liberty, at the head of tide water, a distance of 39 miles. The river empties into Galveston Bay through several mouths or passes, opposite each of which a bar existed on which the depth of water did not exceed 3½ feet at mean low tide.

The project adopted for this improvement on June 18, 1878, consisted in the removal of snags from the river below Liberty and in dredging a channel 80 feet wide by 6 feet deep across the bar at the mouth of the pass then in use by vessels. The estimated cost of the work was $22,581.40. (See Annual Report of the Chief of Engineers for 1873, p. 685 et seq.) On May 4, 1889, an amended project was adopted. It contemplated the erection of two parallel jetties at the mouth known as the Middle Pass, placed about 275 feet apart and extending about 7,750 feet into Galveston Bay; also in closing the other two principal passes by submerged dams, the object being to create and maintain a channel 6 feet deep at mean low tide at the mouth of the river. The revised cost of the improvement was placed at $89,500. (See Annual Report of the Chief of Engineers for 1889, p. 1557 et seq.)

The amount expended on this improvement to the close of the fiscal year ending June 30, 1902, was $77,249.37.

At that date the west jetty had been completed, its length being 7,359 feet, and a channel 100 feet wide by 5 feet deep had been secured at the mouth of the river.

For report upon improving this river under a new and enlarged project, see page 336.

The total amount of freight carried during the fiscal year was 7,000 tons lumber, 1,500 tons wood, and 300 tons general merchandise.

July 1, 1901, balance unexpended	$6,750.63
July 1, 1902, balance unexpended	6,750.63

(*b*) *Cedar Bayou.*—For projects and work done by the United States Government at Cedar Bayou, Texas, see Annual Report of the Chief of Engineers for 1895, page 1815 (Appendix T 5).

The river and harbor act approved June 13, 1902, provides as follows:

> Improving Cedar Bayou, Texas: Maintaining improvement, five thousand dollars: *Provided*, That the dredge constructed for use in this locality shall be available for this work.

No work was done up to the close of the past fiscal year, except to submit project for expenditure of the appropriation.

The amount expended on this improvement to June 30, 1902, was $32,150.

Amount appropriated by river and harbor act approved June 13, 1902	$5,000.00
July 1, 1902, balance unexpended	5,000.00

(*c*) *Channel in West Galveston Bay.*—West Galveston Bay is a body of water covering about 39 square miles, and lies between Galveston Island and the mainland. It extends from Galveston Bay to the west end of Oyster Bay, and is connected with the Gulf of Mexico by San Luis Pass, at the western extremity of Galveston Island, and with the

Brazos River by the Galveston and Brazos Canal. The natural depth of the bay was from 2½ to 3 feet.

The project for improving the bay was adopted on June 13, 1892, and proposed widening, deepening, and straightening the channel so as to give a width of 200 feet and a least depth of 3½ feet from Galveston Bay to San Luis Pass and a channel 100 feet wide and 3 feet deep along Christmas Point in Oyster Bay, both channels to be properly defined by beacons. The estimated cost of the improvement was $28,998.80. (See Annual Report of the Chief of Engineers for 1892, p. 1556 et seq.) On July 8, 1896, authority was given to modify the project so as to afford a depth of 5 feet instead of 3½ feet, provided the cost of the work should not be increased.

The amount expended to June 30, 1902, was $19,775.97.

This expenditure resulted in an unobstructed channel 100 feet wide and from 3 to 3½ feet deep from Galveston Bay to the Galveston and Brazos Canal. Beacons were also erected to define the channel.

No work was done during the past fiscal year.

No commercial statistics for the fiscal year ending June 30, 1902, could be obtained.

July 1, 1901, balance unexpended	$5,224.03
July 1, 1902, balance unexpended	5,224.03

(*d*) *Brazos River.*—This improvement is at present limited to that portion of the river lying between Richmond and Velasco, a distance of about 89 miles; its low-water level is affected by the Gulf tide as far up as Bolivar Landing, 40 miles above Velasco. The course of the river is tortuous, and the channel was obstructed by shoals and snags.

The project for improvement was adopted June 3, 1896, and proposed the removal of snags and overhanging trees. It was estimated that $10,000 would put this portion of the river in good navigable condition at ordinary stages, and that an annual expenditure of $2,500 would keep it in this condition. (See Annual Report of the Chief of Engineers for 1895, p. 1838 et seq.)

No work has been done under this project.

The amount expended on this improvement to June 30, 1902, was $22.35.

No commercial statistics for the fiscal year ending June 30, 1902, could be obtained.

July 1, 1901, balance unexpended	$4,977.65
July 1, 1902, balance unexpended	4,977.65

(See Appendixes U 7–11.)

8. Brazos River, Texas, from Richmond to old Washington.—The river and harbor act approved June 13, 1902, provides as follows:

> Improving Brazos River, Texas, from Richmond to Old Washington, in accordance with the second plan of the report submitted in House Document Numbered Two hundred and eighty-three, Fifty-sixth Congress, second session, one hundred and fifty thousand dollars.

The plan referred to is printed in the Annual Report of the Chief of Engineers for 1901, page 1974 et seq.

No work was done up to the close of the fiscal year, except to submit project for expenditure of the appropriation.

Amount appropriated by river and harbor act approved June 13, 1902	$150,000.00
July 1, 1902, balance unexpended	150,000.00

(See Appendix U 12.)

9. Mouth of Brazos River, Texas.—The improvement of the mouth of this stream was at first undertaken by the Brazos River Channel and Dock Company, which has partially constructed a system of parallel jetties.

The river and harbor act approved March 3, 1899, contains the following item:

> Mouth of Brazos River, Texas: For dredging and such other work as may be deemed most effective in the judgment of the Secretary of War in improving and developing the harbor, eighty-five thousand dollars: *Provided*, That no part of said sum shall be expended until the Brazos River Channel and Dock Company shall file with the Secretary of War a transfer to the United States of the jetties and auxiliary works; also a release of all rights and privileges conferred upon said company by its charter or by the Act of Congress approved August ninth, eighteen hundred and eighty-eight, to charge or collect tolls for the use and navigation of said river; and the Secretary of War is directed to have an examination made of the mouth of the Brazos and the jetties, and report to Congress the estimated cost of extending the jetties one-half mile, and the estimated depth and width of the channel to be obtained by such extension, and the estimated cost of obtaining twenty feet of water and a channel one hundred and fifty feet wide.

Under date of April 25, 1899, the Brazos River Channel and Dock Company filed with the Secretary of War a transfer to the United States of these jetties and auxiliary works; also a release of all rights and privileges conferred upon the said company by its charter or by the act of Congress approved August 9, 1888, to charge or collect tolls for the use and navigation of the river.

The proposed work at this locality consists in putting the present jetties at the mouth of the river in a fair condition to resist the effects of storms and to protect a dredge while working between them; also to make a beginning in the construction of spur dikes to narrow the channel between the jetties, and to dredge a channel as far up as the light-house to a depth of 18 feet at mean low tide and 150 feet wide.

The amount expended on this improvement up to June 30, 1902, was $230,622.56.

No work was carried on during the past fiscal year.

The condition of the jetties before and after the hurricane of September 8, 1900, is given in the Annual Report of the Chief of Engineers for 1901, page 1940 et seq.

The estimate for completion of existing project has been increased by $175,000, the amount estimated by Board of Engineers to be necessary for repair of damages by the hurricane of September 8, 1900. The report of the Board is printed in House Doc. No. 133, Fifty-sixth Congress, second session.

No commercial statistics for the fiscal year ending June 30, 1902, could be obtained.

The river and harbor act approved June 13, 1902, appropriated $50,000 for continuing the improvement.

July 1, 1901, balance unexpended	$13,479.27
Amount appropriated by river and harbor act approved June 13, 1902	50,000.00
	63,479.27
June 30, 1902, amount expended during fiscal year	351.83
July 1, 1902, balance unexpended	63,127.44

(See Appendix U 13.)

10. Aransas Pass, Texas.—Aransas Pass is on the south coast of Texas, 175 miles southwest of Galveston and 125 miles north of the Rio Grande, and is the outlet of Aransas Bay to the Gulf of Mexico. The area of the bay is about 80 square miles. It is connected with Corpus Christi Bay on one side and with the shallow bays of Mosquite, St. Charles, and Copano on the other.

For projects and work done by the United States Government and private coporations at Aransas Pass, see Annual Report of the Chief of Engineers for 1898, page 1527 et seq.

The river and harbor act of March 3, 1899, contained the following item:

Improving Aransas Pass, Texas: For dredging and other improvement of Aransas Pass Harbor, sixty thousand dollars: *Provided*, That the Secretary of War is hereby authorized to contract for the removal of that portion of the old Government jetty in said harbor from the end nearest the curved jetty constructed by the Aransas Pass Harbor Company to the wreck *Mary*, in such manner as to in nowise interfere with the curved jetty now located in said harbor: *And provided further*, That said contract shall not be let by the Secretary of War nor said work done until the said Aransas Pass Harbor Company shall have properly released and surrendered all rights and privileges heretofore granted to it in said harbor by Congress, also the jetty constructed in said harbor.

The Aransas Pass Harbor Company, under date of March 27, 1899, released and surrendered all rights and privileges heretofore granted to it in Aransas Pass Harbor by Congress; also the jetties constructed in said harbor.

For condition of the jetties and pass at the time the works were surrendered to the United States, see map accompanying Annual Report of the Chief of Engineers for 1900, page 2336.

At the beginning of the fiscal year the approved project for the expenditure of the available funds consisted in repairing the curved jetty from inner end of existing structure so far as available funds would permit.

Articles of agreement were being prepared at beginning of fiscal year and were approved July 19, 1901. Contractors began operations October 1, 1901, and completed all work under their contract by April 23, 1902. One thousand three hundred feet of jetty was completed.

The river and harbor act of June 13, 1902, contains the following item:

Improving Aransas Pass, Texas: Continuing improvement, two hundred and fifty thousand dollars: *Provided*, That the work at this harbor shall be confined to the completion of the north jetty in accordance with the design and specifications of the Aransas Pass Harbor Company, and in continuation of the work heretofore carried out on said jetty by said company, and to such additional work as may be necessary for strengthening such jetty, and for the removal of such part of the old Government jetty and any other hard material which may interfere with the formation of a channel by the natural action of the currents.

The amount expended on this improvement to June 30, 1902, was $635,660.92, exclusive of $9,938.93 subscribed by the citizens of Rockport and Corpus Christi.

No commercial statistics for the fiscal year ending June 30, 1902, could be obtained.

July 1, 1901, balance unexpended	$92,555.28
Amount appropriated by river and harbor act approved June 13, 1902	250,000.00
	342,555.28
June 30, 1902, amount expended during fiscal year	86,966.20
July 1, 1902, balance unexpended	255,589.08
July 1, 1902, outstanding liabilities	405.03
July 1, 1902, balance available	255,184.05

(See Appendix U 14.)

11. Harbor at Brazos Santiago, Tex.—No work has been done on this improvement since 1884. This work was dropped from the list of improvements in the Galveston district in December, 1895, and the available balance returned to the Treasury.

Owing to the shoaling of the bar, practically cutting off all water communication, authority was secured to use the balance, $57,476, remaining in the Treasury, it being the intention to dredge a channel over the bar to give temporary relief to the locality.

As reports received as to depth on the bar showed a navigable depth of 9 feet, which would permit small coastwise steamers to enter, no work was attempted during the fiscal year.

The amount expended during the past fiscal year was $350. This amount was withdrawn from the appropriation by the Office of the Chief of Engineers for expenses of that office.

The amount expended on this improvement to June 30, 1902, was $192,663.16.

No commercial statistics for the fiscal year ending June 30, 1902, could be obtained.

July 1, 1901, balance unexpended	$55,186.84
June 30, 1902, amount expended during fiscal year	350.00
July 1, 1902, balance unexpended	54,836.84

(See Appendix U 15.)

12. Removing sunken vessels or craft obstructing or endangering navigation.—During the hurricane which visited Galveston September 8, 1900, a great many barges, schooners, etc., and one steam vessel were wrecked and sunk in Galveston Bay and vicinity, and same have become a menace to navigation.

At the beginning of the past fiscal year contract had been entered into for removing the following wrecks: Steamer *Cumberland*, an iron tank, barges *Jules* and *Alice*, and tug *Kate*. These wrecks were completely removed by October 22, 1901.

The total cost of removing these wrecks was $2,492.27. A statement contained in the report of the local engineer officer shows the items of expenditure.

Under date of February 25, 1902, authority was granted, and an allotment of $3,000 was made, for removing wrecks in Galveston Bay and Buffalo Bayou, Texas.

The wrecks to be removed are: Dredge No. 3, barge No. 3, a dredge-boat, and flatboat *Daisy*.

Contract has been entered into for removing these wrecks, and con-

tractor was engaged in removing wreck of dredge No. 3 at close of fiscal year.

The amount expended during the fiscal year for removing these wrecks was $122.19.

(See Appendix U 16.)

EXAMINATION AND SURVEY MADE IN COMPLIANCE WITH EMERGENCY RIVER AND HARBOR ACT APPROVED JUNE 6, 1900.

Captain Riché submitted through the division engineer reports dated November 14, 1900, and January 29, 1901, on examination and survey, respectively, of the *inner harbor of Galveston, Tex.* The plan presented contemplates improvement at an estimated cost of $2,250,000, concerning which the Chief of Engineers in submitting the report to the Secretary of War stated:

> In my opinion the work covered by this survey is of importance to local interests rather than to general commerce, and its undertaking by the General Government is a proposition I am unable to commend for favorable consideration.

The reports were transmitted to Congress and printed in House Doc. No. 91, Fifty-seventh Congress, first session. (See also Appendix U 17.)

WESTERN RIVERS.

IMPROVEMENT OF CERTAIN RIVERS AND WATERWAYS IN LOUISIANA, ARKANSAS, AND MISSISSIPPI TRIBUTARY TO MISSISSIPPI RIVER.

This district was in the charge of Maj. Thos. L. Casey, Corps of Engineers, to October 31, 1901, and in the temporary charge of Capt. Chas. L. Potter, Corps of Engineers, since that date. Division Engineer, Col. Amos Stickney, Corps of Engineers, to July 24, 1901, and Lieut. Col. H. M. Adams, Corps of Engineers, since that date.

1. Red River, Louisiana, Arkansas, and Indian Territory.—In 1828 Congress entered upon a plan for improving the navigation of Red River through or around the great raft in Louisiana and Arkansas, and from 1828 to 1852 appropriations for the purpose were made aggregating the sum of $535,765.50, of which $532,219.90 was expended on the improvement and $3,545.60 carried to the surplus fund. No appropriation was made between 1852 and 1872, and during that long interval the results of former work were lost.

When work for the improvement was resumed in 1872 the river above Shreveport, La., was closed by the great raft, then 32 miles long and constantly growing, and below Shreveport the enlargement of the outlet through Tones Bayou was depleting the main channel and threatening its closure to navigation. The falls at Alexandria, La., were impassable at low stages, navigation was difficult and dangerous at all places and at all times on account of the great number and constant additions of snags, stumps, sunken logs, and leaning trees, and there were more than 200 steamboat wrecks in the channel between the mouth and the head of navigation. The river shifted its channel frequently, and during periods of flood inundated the whole valley, creating a vast network of streams, some of which were navigable. The bed of the river in the raft regions, both above and below Shreveport, was a mass of sunken logs and stumps, portions of which

were constantly scouring loose, while others, thoroughly water-logged, remained to cause deposits and create bars, impassable at low stages. The banks were heavily timbered, and each flood caused them to cave and slide, contributing enormous quantities of drift to create jams or raft, and exposing dangerous shore snags, which projected far out into the stream as its channel changed.

The project adopted in 1872 contemplated removing the raft above Shreveport and closing Tones Bayou outlet. Under subsequent acts of Congress it was amplified to include work for opening and enlarging the channel through the falls at Alexandria; the removal of jams, snags, wrecks, leaning timber, etc.; deepening shoal places, and closing outlets. In the river and harbor act of 1892 Congress adopted a project which contemplated the systematic clearing of the banks, to remove the source of drift and snags; continuing snagging operations and the removal of jams or raft; dredging towheads and shoals; constructing a substantial system of levees, either alone or by cooperating with riparian States, to fix the course of the river; the gradual closure of all outlets which deplete the main river at various stages; the fixing of caving banks to confine the river to the channel selected for it, and the prevention of injury to the regimen of the stream by new cut-offs or outlets. Operations were to extend from the Atchafalaya River, Louisiana, to Fulton, Ark., 508.6 miles, but the river and harbor act of 1899 provided for continuing snagging work above Fulton to the mouth of the Kiamichi River, Indian Territory, about 170 miles upstream. The nature of the work requires that it be continued for many years, and no estimate for completion is given on this account.

The amount expended from 1872 to the close of the fiscal year ending June 30, 1902, was $1,586,780.06, with the following chief results: A channel cleared through the great raft in 1872–73 opened to navigation 188 miles of river between Shreveport and Fulton, and, at high stages, about 170 miles above Fulton. Subsequent work secured the complete removal of the raft, prevented new formations of the same nature, and increased the width of the river 100 feet or more, and there now flows in the course laid out for it through the raft region a broad and deep river, safe for navigation at all but the lowest stages. Ten years ago the bottom line at head of the raft had fallen more than 15 feet, diminishing to about 3 feet at Shreveport, the low-water line having followed it to a certain extent, and the continual scour in that stretch is gradually attaining a normal slope of the river bottom. Incidentally, the removal of the raft drained the fertile valley and reclaimed thousands of acres of productive lands, and the region, formerly a network of lakes and pools, has been brought under cultivation and is traversed by several lines of railway. Tones Bayou outlet was closed in 1899 by a heavy earthen dam, connected with the line of levee above and below it; the main channel of the river below and formerly impaired by that outlet has widened and scoured until it is capable of carrying the discharge at flood stages, and navigation of the stretch is uninterrupted at lowest water. Work at the falls of Alexandria rendered them passable for steamboats at all stages. The channel was deepened from 2½ feet to 5½ feet at the lower falls and to 6 feet at the upper falls, increasing the period of navigation about two months. Persistent snagging operations, repeated from year to year, have kept the river open, prevented formations of raft, reduced the dangers of navigation to a minimum, and enabled steamboats to make regular trips,

the river from the Atchafalaya to Fulton being open for boats of 3-feet draft at stages about a foot above zero of the Shreveport gauge. The maximum draft that can be carried at mean low water is 3 feet to Montgomery, La., 162.5 miles above the Atchafalaya; 2½ feet to Shreveport, La., 320.5 miles; and 2 feet to Fulton, Ark., 508.6 miles. The range between low and high water at the several gauge stations is as follows:

Gauge station.	Low water.		High water.		Range.
	Date.	Gauge reading.	Date.	Gauge reading.	
		Feet.		*Feet.*	*Feet.*
Fulton, Ark	Sept. 19–25, Oct. 20–22, 1896.	0.10	July 17, 1876	35.75	35.65
Garland, Ark	Sept. 22–25, 1896	— .20	Mar. 24, 1894	28.50	28.70
Shreveport, La	Dec. 2–4, 1894	—5.50	May 28, 1892	35.70	41.20
Alexandria, La	Sept. 29, 1881	—3.70	June 12, 13, 1892	38.25	41.95
Red River Landing, La	Nov. 14, 1895	— .60	May 14, 15, 1897	50.20	50.80

All of the chief outlets along the right bank of the river from the Arkansas-Louisiana line to below Tones Bayou have been closed with dams connected with the levee system, and since 1892, in conjunction with the State of Louisiana and local levee districts, 149.76 miles of new levees and 96.38 miles of enlargement, containing 9,699,171 cubic yards of earth were built, at a cost of $1,382,490. The United States built about 15¼ per cent of the whole work. Red River is still in a state of transition and not yet an ideal stream by any means, but for the greater part of its length it now follows a fairly well-defined course, governed here and there by levees and at intervals by natural banks rising above the plane of high water.

The commerce of Red River consists of large shipments of cotton, cotton seed and its products, lumber, staves, saw logs, etc., with heavy return freights of general merchandise and plantation supplies, and for the fiscal year 1902 aggregated 89,219 tons, valued at $3,194,000. The amount of business for the past thirteen years, as reported to and compiled for comparison in the report of the district officer, shows great variations from year to year—probably due to crop conditions, periods of very low water, and other causes—ranging in quantity from 66,376 to 228,630 tons per annum, with estimated values from $3,194,000 to $9,185,000. The average for the thirteen years is 107,158 tons, valued at $5,213,770. To this should be added the commerce of Ouachita River, entering Red River at the mouth of Black River, the average of which is 172,346 tons, valued at $6,394,750, making a total of 279,504 tons, valued at $11,608,520.

July 1, 1901, balance unexpended	$40,845.59
Amount appropriated by river and harbor act approved June 13, 1902	135,000.00
	175,845.59
June 30, 1902, amount expended during fiscal year	30,625.65
July 1, 1902, balance unexpended	145,219.94
July 1, 1902, outstanding liabilities	62.29
July 1, 1902, balance available	145,157.65

(See Appendix V 1.)

2. Cypress Bayou, Texas and Louisiana.—During the period of the great raft above Shreveport, La., the bottom lands of Cypress Bayou were flooded with back water from Red River, and there was a navigable route up the lakes and bayou to Jefferson, Tex. Work by the United States for its improvement commenced in 1872, and in the eight years from 1872 to 1879 the sum of $94,000 was appropriated for that purpose. This money was expended for dredging and straightening the channel, removing stumps, snags, and logs, and cutting leaning timber. The work was completed in 1880, but since 1886 appropriations and allotments amounting to $39,701.33 have been provided with a view to its maintenance and $12,000 for surveys.

The removal of the raft and subsequent closure of outlets and construction of levees along the right bank of Red River cut off the water supply of the lakes, except from natural drainage and during extreme floods, and the period of navigation shortened from year to year until 1897, when it ceased altogether. A survey was made to ascertain if improvement could be obtained by locks and dams, but the plan did not receive the sanction of Congress, presumably because of its great cost in comparison with possible commercial benefits that might result. (See Annual Report of the Chief of Engineers for 1893, pp. 271 and 2065.)

The total amount expended to June 30, 1902, was $140,899.07.

Navigation between Shreveport and Jefferson can be restored only by a system of locks and dams, upon which large sums might be spent for construction and maintenance without any return of commerce. The expenditure of the available funds for dredging or for removal of stumps and snags can afford no relief.

July 1, 1901, balance unexpended	$5,735.36
June 30, 1902, amount expended during fiscal year	933.10
July 1, 1902, balance unexpended	4,802.26

(See Appendix V 2.)

3. Ouachita and Black rivers, Arkansas and Louisiana.—The improvement of Ouachita River was commenced in 1871, at which time navigation was much obstructed by snags, sunken logs, wrecks, leaning and caving trees, etc., and at low stages a greater part of the river was unnavigable on account of numerous rock, gravel, and sand bars.

A project was entered upon in 1871 for a temporary improvement between Arkadelphia, Ark., and Trinity, La., by the removal of snags, etc., and dredging at the worst bars. In 1872 a project was adopted for improvement by locks and dams, but it was abandoned in 1874. The project under which work has continued since contemplated the removal of snags, logs, wrecks, leaning timber, etc., below Camden, Ark., to the mouth of Black River, Louisiana, 350 miles. No estimate of cost is given, as the nature of the work requires that it be continuous.

To comply with a requirement of the river and harbor act of 1894 a resurvey of the river was made for the purpose of preparing new plans and estimates for an improvement by locks and dams, and final report thereon was submitted by the district officer February 22, 1902. (See Appendix V 11 herewith.) The plan presented in that report provides for a navigable depth of 6½ feet from the mouth of Black River up to a point about 10 miles above Camden, Ark., 360 miles,

by a system of nine locks and movable dams, at an estimated cost of $1,998,576. This project was entered upon by a provision in the river and harbor act of 1902 for constructing two of the locks and dams.

The amount expended to June 30, 1902, was $605,802.19, but of that sum $131,295.69 was expended prior to 1874. The work performed since 1874 has consisted chiefly of the removal of snags, logs, wrecks, tree slides, and leaning timber, for the purpose of maintaining navigation, and the improvement of a rock and gravel bar known as Catahoula Shoals, about 20 miles above Trinity, La. At moderately high stages, or during six or seven months of the year, New Orleans steamboats ascend the river to Camden, Ark.; at medium stages they run to Monroe, La.; but during the periods of low water Harrisonburg, La., 72 miles above Red River, is considered the head of navigation, though small local packets make occasional trips between points on the river above. The range between low and high water at the several gauge stations on Ouachita River, is as follows: Camden, Ark., 44.2 feet; Monroe, La., 48.6 feet; Riverton, La., 51.3 feet; and Black River Station, La., 54.1 feet.

The work heretofore done was not directed so much toward an increase of depth as to an increase of safety of navigation. Local work at Catahoula Shoals increased the available depth from 15 to 40 inches. The maximum draft that can be carried at mean low water is 3½ feet to Harrisonburg, La.; 1¼ feet to Monroe, La.; and 8 inches to Camden, Ark.

The commerce of Ouachita River and its tributaries is considerable, consisting of shipments of cotton, cotton seed, lumber, staves, saw logs, and miscellaneous articles, with return freights of general merchandise and plantation supplies, and for the fiscal year 1902 aggregated 313,863 tons, valued at $9,720,000. Most of the cotton is shipped direct to New Orleans, and large quantities of staves are shipped to that city each year for export. The business of the past thirteen years as reported to the district officer, and compiled for comparison in his report, ranges between 73,679 and 313,863 tons per annum, with values estimated at $3,293,000 to $10,234,250. The average for the thirteen years is 172,346 tons, valued at $6,394,750.

July 1, 1901, balance unexpended	$31,889.32
Amount appropriated by river and harbor act approved June 13, 1902	111,500.00
	143,389.32
June 30, 1902, amount expended during fiscal year	25,191.51
July 1, 1902, balance unexpended	118,197.81
July 1, 1902, outstanding liabilities	322.24
July 1, 1902, balance available	117,875.57
Amount (estimated) required for completion of existing project	1,918,576.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	250,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix V 3.)

4. Bayou Bartholomew, Bœuf and Tensas rivers, and Bayous Maçon, D'Arbonne, and Corney, Louisiana and Arkansas.—(*a*) *Bayou Bartholomew.*—The States of Louisiana and Arkansas made expenditures

at various times for improvement of this stream, which was navigated to a considerable extent as far back as 1843. In 1880 it was navigable at high stages during a period of about three months in the year, but an examination made that year showed that the passageway for steamboats was much obstructed by snags, sunken logs, wrecks, leaning timber, etc.

In 1881 Congress entered upon a project for the removal of these obstructions, to afford safe navigation between the mouth and Baxter, Ark., about 180 miles above. After sixteen years, with small and intermittent appropriations, this work was practically completed in 1897 to McComb Landing, Ark., the present head of navigation, about 138 miles above the mouth, at a cost of $45,873.53. The work resulted in safer navigation, increasing the period to about six months of the year, enabling larger boats to make trips in half the time formerly required, and reducing freight rates about 50 per cent. There being no demand for navigation above McComb Landing, subsequent expenditures were for maintenance, the sum of $5,623.32 having been applied to that purpose to the close of the fiscal year ending June 30, 1902, making the expenditures to that date aggregate the sum of $51,496.85.

Drift, caving and sliding banks, and the rapid growth of vegetation constantly add new obstructions, which accumulate rapidly and become more difficult to remove each year. The cost of maintaining unobstructed navigation at stages on which steamboats can run is estimated at $2,500 per year.

The country along Bayou Bartholomew is very productive and well settled, but much of the trade has been diverted to the railroads, the stages of the bayou (formerly the only way of shipment) frequently not being coincident with the needs of transportation. The river trade consists of shipments of cotton, cotton seed, saw logs, staves, and miscellaneous articles, with return freights of general merchandise and plantation supplies. In the twelve years from 1890 to 1901 the freights reported annually ranged between 6,633 and 49,299 tons, with values estimated at $97,000 to $826,000, varying widely according to crop conditions and periods of navigation. The average for the twelve years is 15,720 tons, valued at $373,600. Full statistics for the fiscal year 1902 could not be obtained.

(*b*) *Bœuf River.*—The improvement of this stream was undertaken by the State of Louisiana more than sixty years ago, and navigation to Point Jefferson, La., was opened in 1840. When work by the United States commenced the river was navigable to Point Jefferson at high stages, but passage was difficult and dangerous on account of overhanging timber, and snags and logs in the channel.

The project approved August 19, 1881, contemplated removing these obstructions so as to afford safe navigation at high stages to Wallace Landing, La., 19 miles above Point Jefferson and about 170 miles above the mouth. This work, completed in 1896, at a cost of $40,992.84, put the stream in safe navigable condition at moderate stages and enabled steamboats to save thirty-six hours on the trip, but was not permanent, as new obstructions are added continually.

Under the river and harbor act of 1886 a supplemental project was entered upon for the closure of three outlets near Point Jefferson, to confine the flow to the main channel. In 1887–88 the outlets were closed by uniting with the efforts of the planters whose lands would be protected from overflow, the proportion of the cost borne by the

United States having been $5,441.78. This work caused the bars below the outlets to scour, and gave immediate benefit to navigation, but the dams were destroyed in 1890 during an overflow from the Mississippi River, and funds for their restoration have not been provided. Soundings in 1896 showed a very considerable shoaling below the outlets. The estimated cost of closing them is $30,000. Under project approved March 28, 1899, the closure of the outlets has been deferred until ample funds for the purpose are provided.

The total amount expended to June 30, 1902, was $54,000, of which $7,565.38 was applied to maintenance since 1896.

The commerce of Bœuf River consists of shipments of cotton, cotton seed, and large quantities of staves sent to New Orleans for export, with return freights of general merchandise and plantation supplies, aggregating in the last fiscal year 6,895 tons, valued at $300,000. The amount of business reported for the past thirteen years varies between 2,435 and 11,261 tons per annum, with estimated values ranging from $69,000 to $636,500; the average being 6,932 tons, valued at $299,100.

As no provision for closing the outlets near Point Jefferson has been made in the twelve years since the dams were destroyed, it appears to be the intention of Congress to abandon that part of the improvement. The funds available will be applied to work of maintenance.

(*c*) *Tensas River and Bayou Maçon.*—These streams were navigable at high stages before their improvement was undertaken by the United States, but passage for steamboats was difficult and dangerous on account of leaning timber and of numerous snags, logs, stumps, etc., in the channel.

The project approved April 1, 1881, contemplated removing the obstructions in Tensas River between its mouth and Dallas, about 134 miles above, to give ease and safety to and extend the period of navigation. Bayou Maçon, the chief commercial branch of Tensas River, was added under the same head of appropriation by river and harbor act of 1884, and the project, approved July 26, 1884, contemplated the same class of work from the entrance of the bayou into Tensas River to Floyd, 112 miles above.

The original plans were for completing work in both streams in one season of low water at a cost of $40,000, which is the total of all appropriations made in the twenty years from 1881 to 1901.

The amount expended to the close of the fiscal year ending June 30, 1902, was $39,762.09. The project for improving Bayou Maçon was completed in 1899 at a cost of $23,915.42; and work in Tensas River to Westwood Place, about 75 miles above its mouth, was completed at a cost of $11,947.02. Tensas River above Westwood Place remained unnavigable, and there was no demand for its improvement until 1899, when efforts were made to induce settlement of deserted plantations along its banks and to secure a continuance of the improvement to Dallas. Since 1899 the sum of $3,899.65 has been expended for maintenance of the improvement from Floyd, on Bayou Maçon, to the mouth of Tensas River.

As new obstructions are adding continually, about $2,500 per annum will be required for maintenance of the work accomplished. Both streams are navigated by steamboats from the Ouachita at moderately high stages. There is no navigation at low water.

The commerce of the river and bayou consists chiefly of shipments

of cotton, cotton seed, staves, etc., with return freights of plantation supplies and general merchandise. The amount of business, as reported for the past thirteen years, ranges from 2,649 to 23,605 tons per annum, with values estimated at $122,500 to $999,500. The average for the thirteen years is 14,493 tons, valued at $539,500. The commerce of the fiscal year 1902 aggregated 15,938 tons, valued at $428,000.

(*d*) *Bayous D'Arbonne and Corney.*—When this work commenced Bayou D'Arbonne was reported navigable six or seven months of the year, but the channel was so obstructed by snags, stumps, sunken logs, leaning trees, etc., that passage was difficult and dangerous at all stages.

The project adopted in 1884 contemplated removing the obstructions between the mouth of D'Arbonne and Stein Bluff on the Corney Branch, 42½ miles above, to give greater ease and safety to the passage of boats and extend the period of navigation. The act of 1892 required an expenditure of $1,000 in Bayou Corney, above Stein Bluff, and the act of 1894 required that the same amount be expended for removal of obstructions in Little D'Arbonne.

By the removal of obstructions, the period of navigation was increased fully one month; boats of double the capacity of those used formerly were enabled to make quicker time with greater safety; freight rates were reduced one-half, and navigation was extended up the Corney Branch 16½ miles above Stein Bluff.

The work is not permanent, as new obstructions are added from time to time.

The amount expended on this work was $18,000.

There were no operations during the year, the appropriation of June 13, 1902, being the first made for the locality since 1894.

July 1, 1901, balance unexpended	$14,771.49
Amount appropriated by river and harbor act approved June 13, 1902	15,000.00
	29,771.49
June 30, 1902, amount expended during fiscal year	7,030.43
July 1, 1902, balance unexpended	22,741.06
July 1, 1902, outstanding liabilities	39.24
July 1, 1902, balance available	22,701.82

(See Appendixes V 4–6.)

5. Mouth of Yazoo River, and harbor at Vicksburg, Miss.—The shifting bar at mouth of the Yazoo is the most serious obstruction to navigation of that river and its tributaries, a system comprising about 800 miles of navigable waterways. At low stages steamboats are prevented from entering or leaving the river without lightering, and it frequently happens that navigation across the bar is closed entirely during the busiest season of the year. In the river and harbor act of 1890, Congress ordered a survey, with a view to giving free passage the year round. Report upon the survey was submitted February 4, 1892, and Congress entered upon the proposed plan for improvement in the river and harbor act of 1892.

The project, approved October 15, 1894, contemplated making a new mouth or outlet for Yazoo River from its former mouth on Old River (9.8 miles above the present outlet to the Mississippi), through deep water in Old River, across a neck of low land from Old River to Lake

Centennial, and around the head of De Soto Island and down Lake Centennial to the Mississippi River, entering it upon the channel side at Kleinston Landing. Lake Centennial is an old bend of the Mississippi River, cut off in 1876 above the present low-water landing at Kleinston, and Vicksburg Harbor is that part of the former channel along the city front and extending down to Kleinston Landing. The original estimate of cost, $1,500,000, was revised in 1893 and reduced to $1,200,000, upon a basis of completion in three years. The sundry civil act of March 3, 1901, appropriated the balance of the latter estimate.

The amount expended to the close of the fiscal year ending June 30, 1902, was $798,492.72. The right of way for the main cut between Old River and Lake Centennial was acquired by purchase; borings were made to determine the character of the material to be removed; the entire line from Old River to Kleinston Landing was cleared and grubbed, the débris removed or burned; and 5,094,335 cubic yards of earth was excavated along the diversion route. The estimated quantity of excavation required to complete the work is 918,880 cubic yards, and is under contract to be completed by May 19, 1903.

For detailed information respecting the work reference is invited to the report of the survey upon which the project is based (Annual Report of the Chief of Engineers, 1892, p. 1626) and to subsequent reports of operations. (Annual Reports of the Chief of Engineers for 1893, p. 2029; 1894, p. 1488; 1895, p. 1933; 1896, p. 1618; 1897, p. 1927; 1898, p. 1625; 1899, p. 2015; 1900, p. 2524; and 1901, p. 2052.)

In a special report on the subject of this improvement, dated June 28, 1902, Captain Potter, the local engineer, discussed a plan for preventing the circulation of eddy currents and consequent deposits in the harbor, and proposed the construction of a levee from a point near the mouth of the harbor, along the bank of the Mississippi, across West Pass and to high ground at or near Kings Point. The plan was considered by a Board of Engineers and approved for a levee from a point some distance below Kings Point, with the canal end turned toward De Soto Island for a distance of about 500 feet; this levee to be extended to Kings Point if found necessary.

Statistics of the commerce of the mouth of Yazoo River and Vicksburg Harbor have been collected, as far as practicable, for the past seven years. The average of the entire commerce reported for the seven years is 321,594 tons, valued at $8,753,650 per annum.

July 1, 1901, balance unexpended	$776,998.25
June 30, 1902, amount expended during fiscal year	375,490.97
July 1, 1902, balance unexpended	401,507.28
July 1, 1902, outstanding liabilities	11,535.87
July 1, 1902, balance available	389,971.41
July 1, 1902, amount covered by uncompleted contracts	115,347.40

(See Appendix V 7.)

6. Yazoo River and its tributaries, Mississippi—(a) Yazoo River.—Before this work was commenced the period of navigation was limited to high stages on which steamboats could pass the wrecks of gunboats, steamers, and rafts sunk to prevent passage during the war of the secession, and the channel, also, was much obstructed by a great number of snags, stumps, tree slides, and sunken logs, and by a heavy growth of leaning timber along the banks.

Under river and harbor act of 1873, nine wrecks were removed by contract in 1873–74, and in 1874 a project was submitted for clearing the river of existing obstructions in a period of four years at a cost of $120,000, with annual appropriations thereafter for maintenance. The funds provided by Congress were not sufficient to carry out that plan, and as floods, sliding and caving banks, and the rapid growth of vegetation along an alluvial stream constantly add new obstructions, and render snagging operations necessary from year to year in the interest of safe and uninterrupted navigation, the work has continued under a project for the removal of obstructions so far as funds provided will permit.

The amount expended during the twenty-nine years ending June 30, 1902, was $285,985.62, an average of less than $10,000 a year, including all charges for purchase and repairs and care of plant when not in commission. The results of the work performed, however, are marked. The large number of wrecks that blocked the channel at low stages and limited the period of navigation had been removed so as to present no obstruction, and the work for the removal of snags, logs, leaning timber, etc., repeated from time to time, opened and maintained steamboat navigation from the mouth to the head of the river. Various reaches were more or less obstructed at the lowest stages, but steamboats of 3½ feet draft navigated the river at mean low water without serious difficulty, except in crossing the bar at the mouth. The range between low and high water at Yazoo City is 40.8 feet.

The commerce of Yazoo River and tributaries, as reported for the past twelve years, ranges between 102,098 and 267,257 tons annually, with values estimated at $2,840,000 to $9,198,000. The average for the twelve years is 196,127 tons, valued at $5,278,900.

The chief shipments are cotton, cotton seed, lumber, staves, etc., with return freights of general merchandise and plantation supplies.

(*b*) *Tallahatchie River.*—Before this work was undertaken the river was navigable to Sharkey, about 65 miles above its mouth, for six months of the year, but passage for steamboats was difficult and dangerous at all stages on account of the great number of obstructions in the channel and along the banks. Above Sharkey the growth of leaning timber was heavy, and at places the boughs from both banks overlapped. This condition, together with the number of snags, logs, and stumps in the channel, rendered that part of the stream practically impassable.

A project for improvement was entered upon in 1879, contemplating removal of the wreck of the ocean steamship *Star of the West*, sunk in the channel about 8 miles above the mouth during the war of secession, and of snags, sunken logs, leaning timber, etc., so as to give ease and safety to navigation from the head of Yazoo River to mouth of the Coldwater River, about 100 miles above. It was proposed to do the work then required in two seasons at a cost of $40,000, but the entire amount appropriated from 1879 to 1901 was but $55,500, of which sum the river and harbor acts of 1880, 1881, and 1882 required an expenditure of $10,000 above mouth of the Coldwater to Batesville. As new obstructions are constantly brought into the river by drift and by sliding and caving banks, as the timber grows rapidly along shore, and as the shifting and scouring of the channel discloses snags and logs embedded in the bottom or lodges them upon bars, an additional estimate was approved March 21, 1899, for an expenditure of $10,000 in

one working season to put the river in fairly good navigable condition between Yazoo and Coldwater rivers, and for about $2,500 a year thereafter for maintenance.

The amount expended to June 30, 1902, including the $10,000 applied above mouth of the Coldwater, was $55,500, which benefited navigation considerably. The wreck of the steamship *Star of the West* was destroyed and obstructions were removed from the channel and banks so as to permit steamboats of 3 feet draft to run to Sharkey the year round and to Coldwater River at moderately high stages.

The commerce of Tallahatchie River consists chiefly of shipments of cotton, cotton seed, and timber, with return freights of general merchandise and plantation supplies. The totals reported for the past twelve years range between 22,132 and 92,817 tons per annum, with values estimated at $735,000 to $2,630,000, the average for the period being 49,180 tons, valued at $1,546,750. The commerce reported for the fiscal year 1902 aggregated 62,191 tons, valued at $2,630,000.

(*c*) *Big Sunflower River.*—An examination of this river in 1878 showed that it was navigable for very light boats about six months of the year, but that navigation was much obstructed by snags, sunken logs, sand bars, and shoals; that leaning timber impeded navigation at all stages, and that the low-water channel at many places was so choked with obstructions as to afford no greater depth than 18 inches, and so narrow as to give passage only for the smallest craft.

A project for improvement was commenced with an appropriation of $20,000 in the river and harbor act of 1879. The original plan contemplated completion of work for removal of obstructions to Clarksdale, about 180 miles above the mouth, and the construction of wing dams to scour a depth of about 40 inches on the bars, in three to four consecutive seasons of low water, at a cost of $66,000. During the first four years $37,000 was appropriated, and fairly good progress was made. Since 1882, however, the appropriations have been small, permitting an average annual expenditure of $2,000, and little has been accomplished beyond a partial maintenance of the early work.

New obstructions are added constantly by the rapid growth of vegetation along the banks, and by floods, caving and sliding banks, etc., and under an estimate approved March 21, 1899, $20,000 will be required to complete the improvement and $3,000 annually thereafter for maintenance.

The amount expended to June 30, 1902, was $77,000. The work performed enabled boats of 2½ feet draft to run to Woodburn, 77 miles above the mouth, the year round, and at ordinary stages to make the trip in little more than half the time formerly required, but the passage was difficult and dangerous at low stages. Freight rates were said to have been reduced 50 per cent. Faisonia, about 100 miles above the mouth, was considered the head of navigation.

The commerce of this river consists of shipments of cotton, cotton seed, and miscellaneous articles, with return freights of plantation supplies and general merchandise. The quantities reported annually for the past thirteen years vary between 8,931 and 70,418 tons, with values estimated at $251,000 to $1,734,000. The average for the thirteen years is 35,364 tons, valued at $1,046,000. The commerce reported for the fiscal year 1902 aggregated 70,418 tons, valued at $1,734,000.

(*d*) *Tchula Lake.*—Before improvement was undertaken navigation of the lake was obstructed its entire length by a network of logs lying on

the bottom with arms projecting upward, sawyers, heavy leaning timber, and a thick growth of brush along both banks; the latter at places encroaching on the channel until passage of boats was difficult at any stage.

The project adopted in 1881 contemplated removing these obstructions to prolong the period of navigation and permit light-draft boats to pass through the lake earlier in the cotton season. The work is of temporary character, as obstructions are adding from time to time.

The amount expended is $21,000, with which the greater portion of the leaning timber was cleared and the main obstructions removed from the channel, giving greater ease and safety to passage of steamboats; but the period of navigation was not prolonged, owing to enlargement of bars in the lake.

No work was done during the year, the appropriation of June 13, 1902, being the first made for this locality since 1894.

July 1, 1901, balance unexpended	$18,579.57
Amount appropriated by river and harbor act approved June 13, 1902	55,000.00
	73,579.57
June 30, 1902, amount expended during fiscal year	9,565.19
July 1, 1902, balance unexpended	64,014.38
July 1, 1902, outstanding liabilities	15.40
July 1, 1902, balance available	63,998.98

(See Appendixes V 8–10.)

SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 18, 1894.

Capt. Chas. L. Potter, Corps of Engineers, submitted final report under date of February 22, 1902, on survey of *Ouachita and Black rivers (one stream, called Ouachita above the town of Trinity, La., and Black below that place) and tributaries.* The plan of improvement presented contemplates the construction of a system of locks and movable dams to provide a navigable depth of 6½ feet from the mouth of the river up to a point above the town of Camden, Ark., a distance of about 360 miles, at an estimated cost of $1,998,576. The following tributaries were included in the survey: Tensas River and Bayou Maçon, Louisiana; Bœuf River, Louisiana and Arkansas; Saline River, Arkansas; Bayou Bartholomew, Louisiana and Arkansas; Bayou D'Arbonne, Louisiana. The report was transmitted to Congress and printed in House Doc. No. 448, Fifty-seventh Congress, first session. (See also Appendix V 11.)

IMPROVEMENT OF ARKANSAS RIVER AND OF CERTAIN RIVERS IN ARKANSAS AND MISSOURI.

This district was in the charge of Capt. Graham D. Fitch, Corps of Engineers. Division Engineer, Col. Amos Stickney, Corps of Engineers.

1. Arkansas River, Arkansas.—In its original condition the channel of the river was greatly obstructed by shifting sand bars and numerous snags in its lower reaches, and by gravel and rock shoals and some snags in its upper reaches. Navigation was difficult and uncertain at medium and low stages, and during periods of extreme low water was impossible.

Prior to act of Congress approved June 13, 1902, the work on this river has been carried on under two general projects—one entitled "Removing obstructions in Arkansas River, Arkansas and Kansas," the other "Improving Arkansas River, Arkansas."

The original project for "Removing obstructions in Arkansas River, Arkansas and Kansas" (act July, 1832), was to remove snags and wrecks. Subsequently this project was enlarged to include removing bars by wing dams, and many of the appropriations were made for this work in combination with other rivers. By act of March 3, 1879, Congress adopted an additional project—that of improving the river between Fort Smith, Ark., and Wichita, Kans., by removing the snags and rocks and constructing dams at some of the worst shoals. Later these projects were merged into one, making the project extend from the mouth of the river to Wichita. Under these projects there was expended to June 30, 1902, $968,256.81.

The original projects for "Improving Arkansas River, Arkansas." were local and had in view the permanent improvement of the river at Fort Smith, Vanburen, Dardanelle, and Pine Bluff. By act of August 11, 1888, Congress adopted a general project, namely: "That the Secretary of War shall expend the appropriation under this head with reference to the final improvement of this river as contemplated in the report of the Chief of Engineers for the year ending July 1, 1885, and as authorized in the act for the improvement of rivers and harbors, approved August 5, 1886, and in House Ex. Doc. No. 90, Forty-ninth Congress, first session, said methods to be applied as the Secretary of War may direct at such points between Wichita, Kans., and the navigable mouth of the Arkansas River at its junction with the Mississippi River, as he may deem for the best interest of commerce." The "said methods" referred to in the act were "To remove rock and gravel reefs by blasting and dredging, to contract the channel by dikes and dams, permeable or solid, of such construction as the local conditions require, and to hold the channel so obtained by revetment where necessary." The improvement authorized by the act covers 771 miles, while estimates had been rendered for 708 miles, thus making the estimated cost of the improvement under this project indefinite. Act of August 18, 1894, authorized the operation of snag boats under this head in addition to similar operations under the project "Removing obstructions in Arkansas River, Arkansas and Kansas." To the close of the fiscal year ending June 30, 1902, there had been expended under the general project for Improving Arkansas River, Arkansas, $903,311.93 for original construction, $314,119.14 for maintenance, and $63,397.32 for operating snag boats, making the total amount $1,280,828.39.

Act of Congress, approved June 13, 1902, merged these two general projects into one, which makes the existing project in substance: "The improvement of the river from its mouth to the head of navigation by snagging operations, by dredging operations, and by contraction works, holding the improved channel by revetment where necessary." No definite estimate of cost can be given.

No expenditures have yet been made under this consolidated project.

Aside from the protection to the town front of Pine Bluff and the preservation of channel through the drawspans of the railway bridges at Fort Smith, Vanburen, and Little Rock, the operations for the permanent improvement of the stream have been of no material benefit

to navigation. Snagging operations give immediate relief, but the benefit is temporary.

During the low-water period of this fiscal year navigation was suspended out of Little Rock from June 20, 1901, to December 14, 1901 (excepting five days in August), and again from December 14, 1901, to February 20, 1902 (excepting ten days late in January and early in February); out of Pine Bluff, from July 11, 1901, to August 8, 1901, and again from August 29, 1901, to December 16, 1901; and over the entire river it was suspended for a period of fifty-three days. The channel depths during lowest water were about 20 inches to Silver Lake, and about 12 inches above that place. The river has an average annual range of about 16 feet, and an extreme range of 28.4 feet.

COMMERCIAL STATISTICS, YEAR ENDING MAY 31.

Year.	Value.	Tons.	Year.	Value.	Tons.
1894	$2,846,395	63,563	1899	$2,470,131	68,057
1895	2,380,420	50,498	1900	2,078,940	75,654
1896	2,408,720	54,261	1901	2,623,797	71,998
1897	1,657,218	66,077	1902	1,630,297	40,557
1898	1,626,756	58,578			

Thirty per cent of the commerce reported this year was rafted. Plantation products and supplies, staves and general merchandise constitute the bulk of the steamboat commerce.

Snagging on the stream must be renewed each year, making this work more of the nature of maintenance than of additional improvement or extension of benefits.

The expenditures this year were for part payment of repairs to snag boat *C. B. Reese*, contract for which was completed October 25, 1901, for care of plant, and for general expense. The available funds will be expended in snagging operations, and in part toward procuring a self-propelling hydraulic dredge and snag boat.

In the annual report for 1896, on page 1650, there is given an abstract of the work done under the head "Removing obstructions in Arkansas River, Arkansas and Kansas," and on pages 1652 to 1655 of same report there is given the location and description of all works built for the permanent improvement of the river prior to that year. Reports of the principal examinations and surveys are given in the following-named documents:

Survey from Fort Gibson to Wichita, Kans., House Ex. Doc. No. 90, Forty-ninth Congress, first session; survey from Fort Gibson to Little Rock, House Ex. Doc. No. 295, Forty-first Congress, second session; survey from Little Rock to Mississippi River, Annual Report of the Chief of Engineers for 1885, page 1604; report of Board of Engineers on improvement from Wichita to mouth, House Ex. Doc. No. 234, Fiftieth Congress, first session, and Annual Report of the Chief of Engineers for 1888, page 1389; and report of Board of Engineers on examination and survey of Arkansas River with a view to its permanent improvement, House Doc. No. 150, Fifty-sixth Congress, second session, and Annual Report of the Chief of Engineers for 1901, page 2128.

REMOVING OBSTRUCTIONS IN ARKANSAS RIVER, ARKANSAS AND KANSAS.

July 1, 1901, balance unexpended		$8,071.59
June 30, 1902, amount expended during fiscal year		8,044.94
July 1, 1902, balance unexpended		26.65
July 1, 1902, outstanding liabilities		26.65

IMPROVING ARKANSAS RIVER, ARKANSAS.

July 1, 1901, balance unexpended		$8,526.00
Amount appropriated by river and harbor act approved June 13, 1902		110,000.00
		118,526.00
June 30, 1902, amount expended during fiscal year:		
General improvement	$1,035.62	
Removing obstructions, etc.	5,818.77	
		6,854.39
July 1, 1902, balance unexpended		111,671.61
July 1, 1902, outstanding liabilities		286.61
July 1, 1902, balance available		111,385.00

(See Appendix W 1.)

2. White River, Arkansas.—In its original condition this river was much choked by logs, snags, and drift in its lower reaches, and in its upper reaches—i. e., above Jacksonport—by gravel shoals, bowlders, and some snags.

The original project (act of March 3, 1871) was to remove snags and similar obstructions, the work being combined with similar work on Black and Little Red rivers. Act of June 23, 1874, extended the improvement to Forsythe, Mo., the project being to remove snags and bowlders and to contract the water width at shoals. During the period 1873–1884 the snagging operations on the lower river were in connection with similar work on St. Francis River, while the improvement above Jacksonport was under appropriations confined to that portion of the stream. The act of July 5, 1884, was the first independent appropriation for the river as a whole. It readopted and consolidated into one the separate projects and provided for a survey with a view to the permanent improvement of the river from Forsythe, Mo., to the mouth. The project of 1888 (Annual Report of the Chief of Engineers for 1888, p. 1406) was to deepen the water on shoals by contracting the channel and to remove rock, bowlders, and snags from the channel, the object being to obtain a channel 5 feet deep at low water from the mouth to Newport and 2 feet deep from Newport to Buffalo Shoals at an estimated cost of $105,815, with an additional amount of $8,000 a year for two or three years for snagging. For reasons given in the Annual Report of the Chief of Engineers for 1891, page 2049, the estimates were inadequate to accomplish the object. The act of July 13, 1892, appropriated $53,815 to complete the project, and an additional sum of $21,185 to be expended "in the discretion of the Secretary of War." These funds and those appropriated since have been expended on the lines of the project of 1888, with the addition of dredging on the shoals. The act of March 3, 1899, adopted a lock and dam project for the improvement of this river above Batesville, thus reducing the scope of the former project to improving the river from the mouth to Batesville by contracting the channel, by

removing rocks, bowlders, and snags, and by dredging, the expenditures to be made in the discretion of the Secretary of War.

It is not practicable to state the expenditures on this river when the work was carried on in connection with other rivers. From the separate appropriations for the whole river, or for reaches of it, to the close of the fiscal year ending June 30, 1902, there had been expended $383,902.70. Of this amount $4,000 was allotted to Cache River; $11,061.46 was spent on special works at Batesville; $166,000 was on projects prior to that of 1888; $108,815 was for original construction under the project of 1888, and $94,026.24 on maintenance of works and on snagging and dredging.

The expenditures this year have been for part payment of rebuilding the snag boat *C. B. Reese*, the contract for which was completed October 25, 1901, and for care of property and for general expense. It is proposed to expend the available balance in maintaining the present channel and plant.

During the low-water season of this fiscal year 2½ feet was reported as the maximum draft that could be taken from the mouth of the river to Newport, the natural depths not being available because of snags. Above Jacksonport navigation was suspended from June 1, 1901, to February 24, 1902.

COMMERCIAL STATISTICS, YEAR ENDING MAY 31.

Year.	Value.	Tons.	Year.	Value.	Tons.
1894	$1,043,438	45,793	1899	$1,619,351	117,891
1895	2,494,377	73,759	1900	2,244,222	134,696
1896	2,056,991	74,882	1901 [a]	1,700,355	148,574
1897	2,435,814	73,962	1902	1,242,438	184,066
1898	1,415,013	102,337			

[a] Corrected to include commerce reported too late for incorporation in former report.

Forty-one per cent of the commerce reported this year was saw logs and railway ties and other timber in rafts. Lumbering produces also the bulk of the steamboat commerce. Plantation products and supplies make up only 3 per cent of the total commerce. The Newport and Memphis Packet Company withdrew from the river this year.

On page 1668 of Annual Report of the Chief of Engineers for 1896 there is given the location of all the principal works built for the improvement of this river. Report of survey from Forsythe, Mo., to the mouth with plans for improvement is given in Annual Report of the Chief of Engineers for 1888, page 1406.

July 1, 1901, balance unexpended		$12,217.69
Amount appropriated by river and harbor act approved June 13, 1902		22,000.00
		34,217.69
June 30, 1902, amount expended during fiscal year		11,305.39
July 1, 1902, balance unexpended		22,912.30
July 1, 1902, outstanding liabilities		209.22
July 1, 1902, balance available		22,703.08

(See Appendix W 2.)

3. Upper White River, Arkansas.—Earlier works on this portion of White River were made under appropriations for improving White River, Arkansas, and have been fully reported upon under that head.

The original condition of the river and previous projects for its improvement are also reported there.

The existing project, based on a report printed in Annual Report of the Chief of Engineers for 1897, page 1992, is to provide slack-water navigation from Batesville, Ark., to Buffalo Shoals, 89 miles, by 10 fixed dams with concrete locks. The locks are to be 175 feet between hollow quoins and 36 feet wide, with a depth of about 4 feet on the lower miter sills. The estimated cost is $1,600,000, based on having funds sufficient to construct one lock and dam complete each working season.

To the close of the fiscal year ending June 30, 1902, there has been expended on this work $300,818.85.

During the year ending June 30, 1902, there was practically nothing done on Lock and Dam No. 1, and the condition of the work is as given in last annual report. At Lock and Dam No. 2 the lock walls, including the backfilling, and the abutment were practically completed.

As none of the locks are yet in operation, navigation during this year has been governed by the conditions in the open river. It was suspended on account of low water from June 1, 1901, to February 24, 1902, excepting during a small freshet of four days in December, 1901.

The funds now available will be used in completing and putting into operation Locks and Dams Nos. 1 and 2.

COMMERCIAL STATISTICS YEAR ENDING MAY 31.

Year.	Value.	Tons.	Year.	Value.	Tons.
1899	$548,335	9,059	1901	$639,855	23,522
1900	1,260,716	39,253	1902	758,040	27,472

Rafted railway ties and cedar make up 33 per cent of the commerce reported this year.

July 1, 1901, balance unexpended		$94,501.37
Amount appropriated by river and harbor act approved June 13, 1902.		270,000.00
		364,501.37
June 30, 1902, amount expended during fiscal year:		
Lock No. 1	$7,618.95	
Lock No. 2	77,701.27	
		85,320.22
July 1, 1902, balance unexpended		279,181.15
July 1, 1902, outstanding liabilities		1,845.84
July 1, 1902, balance available		277,335.31

(See Appendix W 3.)

4. Buffalo Fork of White River, Arkansas.—In its original condition this stream was obstructed by overhanging timber, by bowlders,

and by rocks projecting above the plane of the bed of the shoals. The slope was and is steep and the bends abrupt. The low-water depth on the shoals was and is about 5 inches. Navigation is carried on by flatboats and rafts at medium stages of water.

The existing project, adopted by act of Congress approved March 3, 1899, is to cut the overhanging timber and remove from the shoals the loose and solid rock that projects above the general plane of the shoals, the work to extend from the mouth to Rush Creek, 24½ miles. The estimated cost is $3,500, all of which was appropriated by act of March 3, 1899.

The amount expended on the work to June 30, 1902, is $3,395.

The expenditures for the past year have been for care of property. The work in previous years made the natural channel available to the fullest extent for flatboats and rafts. No further work is intended, and the balance now available will be returned to the Treasury.

COMMERCIAL STATISTICS.

No commerce reported this year. Last year it consisted of 718 tons of rafted railway ties, valued at $1,940. The year previous it consisted of 998 tons of rafted cedar and railway ties, valued at $8,436.

Report of survey, with map, of this stream is given in House Doc. No. 207, Fifty-fourth Congress, second session, and without map in Annual Report of the Chief of Engineers for 1897, page 1994.

July 1, 1901, balance unexpended	$448.44
June 30, 1902, amount expended during fiscal year	343.44
July 1, 1902, balance unexpended	105.00
July 1, 1902, outstanding liabilities	50.25
July 1, 1902, balance available	54.75

(See Appendix W 4.)

5. Cache River, Arkansas.—In its original condition this stream was much obstructed by snags, drift, and overhanging timber. The low-water depth on the controlling shoals was 6 to 8 inches.

The original project, adopted by act of August 11, 1888, was to remove logs, snags, and overhanging trees from the mouth to Riverside, at an estimated cost of $7,000. Act of July 13, 1892, authorized an additional $2,000, making $9,000 expended on this project. Act of August 18, 1894, and act of June 3, 1896, each authorized the Secretary of War to expend $2,000 of the White River appropriations on this stream. The project for expenditure of these allotments (approved by Secretary of War August 11, 1886) was for snagging operations from the mouth of the river to James Ferry. Act of March 3, 1899, made a separate appropriation of $1,000 for this river, that amount to be expended in removing obstructions. It was expended on the lines of the 1886 project, making $5,000 expended under the present project to the close of the fiscal year ending June 30, 1902.

Nothing has been done on this river for two years. Operations in preceding years are said to have made navigation possible on a stage 3 feet less than that required before work was done. Much of this benefit is now lost, and the funds now available will be expended in restoring it. The river is not navigable during low-water period, which in the case of this year continued for eight months.

COMMERCIAL STATISTICS, YEAR ENDING MAY 31.

Year.	Value.	Tons.	Year.	Value.	Tons.
1895	$25,494	12,603	1899	$52,936	7,667
1896	62,483	20,748	1900	29,961	11,215
1897	108,460	34,990	1901 a	30,100	10,374
1898	36,635	10,193	1902	40,301	15,676

a Corrected to include commerce reported too late for incorporation in last annual report.

Eighty-four per cent of the commerce reported this year was rafted saw logs and staves in barges floated with the current. The steamboat commerce was made up principally of railway ties and rough staves.

Reports of the more recent preliminary examinations of this river are given in Annual Report of the Chief of Engineers for 1887, page 1547, and in Annual Report of the Chief of Engineers for 1895, page 2037.

Amount appropriated by river and harbor act approved June 13, 1902... $2,000.00
July 1, 1902, balance unexpended..... 2,000.00

(See Appendix W 5.)

6. Black River, Arkansas and Missouri.—In its original condition this river below the mouth of Current River had, at ordinary low water, a controlling depth of 2 to 2½ feet on the shoals, but this was not available on account of snags and similar obstructions. Above the mouth of Current River, navigation was practically impossible at ordinary low stages and no rafting was possible above the Arkansas and Missouri State line.

The original project, adopted by act of June 14, 1880, contemplated removing logs, etc., cutting down shoals by means of wing dams, and closing some of the most troublesome sloughs. The estimated cost was $80,800. The only modification of the project has been that of changing the estimate to $8,000 a year for maintenance. The district officer recommends that this be increased to $15,000.

To June 30, 1902, there had been expended on this work $110,493.46.

Navigation has been made possible all the year to Poplarbluff, except during periods of such extreme low water as occurred this year, during which time the minimum depths reported were 18 to 20 inches on the shoals between Poplarbluff, Mo., and the mouth of Current River; below the mouth of that river the minimum depth was about 2½ feet. These depths, however, were not available in all cases because of the snags that have accumulated since suspension of operations on November 26, 1900.

The funds now available will be expended in maintaining and operating snag boats.

COMMERCIAL STATISTICS, YEAR ENDING MAY 31.

Year.	Value.	Tons.	Year.	Value.	Tons.
1894	$956,982	87,536	1899	$529,336	83,404
1895	1,085,415	132,433	1900	966,961	129,698
1896	891,437	111,278	1901	989,635	185,714
1897	1,704,799	111,611	1902	919,767	166,213
1898	788,640	115,612			

Sixty-one per cent of the commerce reported this year was made up of timber and rough staves in rafts and barges floated with the current. Lumbering industries produced also the bulk of the steamboat commerce, plantation products and supplies being only 2½ per cent of the total tonnage reported.

On page 1686 of Annual Report of the Chief of Engineers for 1896 is given report of all work done up to and including that year. The report of the examination, upon which the present project is based, is given in Annual Report of the Chief of Engineers for 1880, page 1326.

July 1, 1901, balance unexpended	$263.81
Amount appropriated by river and harbor act approved June 13, 1902	21,700.00
	21,963.81
June 30, 1902, amount expended during fiscal year	257.27
July 1, 1902, balance unexpended	21,706.54

(See Appendix W 6.)

7. Current River, Arkansas and Missouri.—The original condition of this stream was such that no steamboat navigation above the mouth of Little Black River was attempted except when the river was at high stages. Below Little Black River navigation was suspended when the river was below medium stage. The natural depths were not available on account of snags and leaning trees.

Although the United States made some improvements to this stream in 1873, and again in 1882 and 1883, the regular improvement of it was not undertaken until act of Congress of August 18, 1894, adopted a project for its improvement from Vanburen, Mo., to the mouth by snagging operations and by contracting the channel at the worst shoals by wing dams, at an estimated cost of $10,000. The appropriation of June 3, 1896, completed the amount originally estimated for the completion of the project, and all operations since then have been under estimates for maintenance. No wing dams have been built, all operations having been confined to snagging.

To June 30, 1902, there has been expended on this river $21,987.03, $7,000 of which was in the early work mentioned above, leaving $14,987.03 as the amount expended on the existing project. Of this latter amount $4,987.03 was for maintenance.

The operations have made navigation easier and safer, but as new obstructions are continually forming, the snagging operations should be repeated every year. The Annual Report of the Chief of Engineers for 1896 gives the amount necessary annually for maintenance of the channel then cleared as $2,000. It is believed, however, that, for some time at least, this estimate should be increased to $5,000.

The amount now available will be expended in maintaining plant and in snagging operations from the mouth of the river upstream as far as the funds will permit.

COMMERCIAL STATISTICS, YEAR ENDING MAY 31.

Year.	Value.	Tons.	Year.	Value.	Tons.
1895	$362,447	31,205	1899	$239,869	43,050
1896	227,291	29,867	1900	578,834	65,043
1897	581,528	17,078	1901 a	234,555	64,102
1898	306,216	52,417	1902	165,766	37,135

a Corrected to include commerce reported too late for incorporation in former annual report.

Ninety-three per cent of the commerce reported this year was saw logs, railway ties, and squared timber in rafts floated with the current. The steamboat commerce was made up of plantation products, staves, lumber, and saw logs. Steamboat navigation was possible all the year to Johnsons Landing. Above that point rafting of saw logs was impracticable for five and one-half months.

Report of preliminary examination of the river from Vanburen, Mo., to the mouth, being that portion covered by the approved project, is given in Annual Report of Chief of Engineers for 1891, page 2065, and with maps in House Ex. Doc. No. 157, Fifty-first Congress, second session. Report of a subsequent examination of the same portion of the river is given in Annual Report of the Chief of Engineers for 1893, page 2128, and in House Ex. Doc. No. 227, Fifty-second Congress, second session.

July 1, 1901, balance unexpended	$315.91
Amount appropriated by river and harbor act approved June 13, 1902	6,900.00
	7,215.91
June 30, 1902, amount expended during fiscal year	302.94
July 1, 1902, balance unexpended	6,912.97
July 1, 1902, outstanding liabilities	12.97
July 1, 1902, balance available	6,900.00

(See Appendix W 7.)

8. St. Francis and L'Anguille rivers, Arkansas.—(*a*) *St. Francis River.*—In its original condition this stream was not navigable above Lesters Landing at any stage; between Lesters Landing and Marked Tree navigation was possible at high stages only, and below Marked Tree it was difficult at medium and lower stages, and impossible at extreme low water.

The original project, adopted by act of March 3, 1871, contemplated improvement from the mouth to Wittsburg by snagging operations. For the period 1873-1882 the appropriations were made for this work in connection with White River, Arkansas. By act of June 14, 1880, appropriation was made for improving the river from Wittsburg to Lesters Landing, the project for the expenditure of this appropriation being to cut a channel through "The Lake," and clear the river of obstructions by snagging operations. Appropriation made by act of July 5, 1884, was the first separate appropriation for the entire river. The act did not state the limits within which it was to be applied. Under it snagging operations were carried on to the town of St. Francis, Ark., and several of the sloughs or side channels were closed. When the improvement of St. Francis River, Missouri, was begun, (act of August 11, 1888) Kennett, Mo., was taken for the upper limit of this work, making the existing project—

remove logs, drifts, and snags from the channel, and overhanging timber from the banks from the mouth to Kennett, Mo., and to close the chutes and sloughs in the Sunk Lands, so as to make the river navigable at high stages to Kennett, Mo.; at medium stages to Marked Tree, and at low stages to a point 30 miles below Madison, Ark., the estimated cost being $8,000 annually.

The amount expended on this river while in combination with White River can not be determined. From the separate appropriations for the entire river and for reaches of it, the expenditure has been $66,994.85 to June 30, 1902, practically all of which was for snagging and maintenance of channel.

By the early operations the river between Wittsburg and Lesters Landing was improved to such an extent that boats could reach the latter-named place on the same stage that they could reach the former. By subsequent operations the period of navigation below Wittsburg has been lengthened about two months, and above Lesters Landing a fair high-water channel was made. The improvement gained above Marked Tree has not been maintained.

Most of the small balance available at the beginning of this fiscal year was expended caring for the snagboat *A. B. Johnson*.

COMMERCIAL STATISTICS, YEAR ENDING MAY 31.

Year.	Value.	Tons.	Year.	Value.	Tons.
1894	$98,375	19,763	1899	$315,459	27,892
1895	321,439	38,107	1900	194,237	45,065
1896	401,457	67,740	1901[a]	272,609	57,102
1897	1,117,891	97,348	1902	269,190	85,831
1898	237,481	23,819			

[a] Corrected to include commerce reported too late for incorporation in former annual report.

Saw logs make up 96 per cent of the total tonnage reported this year, and rafted saw logs make up 33 per cent of the total tonnage.

Reports of examinations and surveys of this stream are printed as follows:

Survey from mouth to Maumelle Prairie, Annual Report of the Chief of Engineers for 1871, page 356; examination from Greenville, Mo., to Maumelle Prairie, Annual Report of the Chief of Engineers for 1873, page 476; and examination from Greenville, Mo., to Lesters Landing, Annual Report of the Chief of Engineers for 1881, page 1481. Report of survey of St. Francis and L'Anguille rivers with map is printed in House Doc. No. 125, Fifty-fifth Congress, second session, and without map in the annual report for 1898, page 1678.

(*b*) *L'Anguille River.*—By acts of June 18, 1878, March 3, 1879, and June 14, 1880, Congress appropriated $17,000 for snagging operations on L'Anguille River to Marianna. This was finally expended in fiscal year ending June 30, 1887, and, taken in connection with the $66,994.85 expended on St. Francis River, Arkansas, to June 30, 1902, makes $83,994.85 on these two rivers to that date.

No work was done on the river during the fiscal year ending June 30, 1902.

The balance available will be expended in snagging operations.

Report of survey of St. Francis and L'Anguille rivers with map is printed in House Doc. No. 125, Fifty-fifth Congress, second session, and without map in Annual Report of the Chief of Engineers for 1898, page 1678.

July 1, 1901, balance unexpended	$256.19
Amount appropriated by river and harbor act approved June 13, 1902	9,000.00
	9,256.19
June 30, 1902, amount expended during fiscal year	251.04
July 1, 1902, balance unexpended	9,005.15
July 1, 1902, outstanding liabilities	2.67
July 1, 1902, balance available	9,002.48

(See Appendixes W 8 and 9.)

9. St. Francis River, Missouri.—In its original condition this river was not navigable at low stages on account of shoals, snags, and similar obstructions. At higher stages it was difficult on account of snags and overhanging timber.

The original project, adopted by act of Congress approved August 11, 1888, contemplated improvement from Greenville, Mo., to Kennett, Mo., by snagging operations and the removal of shoals about 12 miles below Greenville, at an estimated cost of $7,300, which was not sufficient. After $20,500 had been expended on this work it was discontinued.

The existing project, adopted by act of Congress approved June 13, 1902, is to "clear the river of snags, drifts, and overhanging timber from the head of the Sunk Lands to Chalk Bluff, and to confine the river to one channel; to remove the snags, drifts, and overhanging timber that interfere with navigation at medium and high stages of water from Chalk Bluff to Poplin, Mo.," at an estimated cost of $11,200, and $2,000 per year to remove the annual accumulation of snags after the proposed improvement is once accomplished.

To the close of the fiscal year ending June 30, 1902, there had been no expenditures under the existing project.

Under the previous projects navigation was rendered much easier and the navigable seasons lengthened. These benefits have been lost during the period of no operations.

The available balances will be expended in snagging operations.

COMMERCIAL STATISTICS, YEAR ENDING MAY 31.

Year.	Value.	Tons.	Year.	Value.	Tons.
1894	$145,118	35,826	1899	$72,601	19,359
1895	79,091	23,326	1900	65,647	26,156
1896	135,029	35,197	1901	56,935	13,805
1897	75,425	23,306	1902	13,092	6,420
1898	72,873	23,170			

All commerce reported this year was rafted saw logs and railway ties. There are now no steamboats on this river.

Reports of examinations and surveys of this stream are printed in the following: Annual Reports of the Chief of Engineers for 1873, page 476; 1881, page 1481; 1887, page 1549; 1895, page 2040; 1897, page 1999, and in House Doc. No. 82, Fifty-fourth Congress, second session; and in Annual Report of the Chief of Engineers for 1900, page 2618, and House Doc. No. 41, Fifty-sixth Congress, first session.

Amount appropriated by river and harbor act approved June 13, 1902 .. $10,000.00
July 1, 1902, balance unexpended 10,000.00

(See Appendix W 10.)

REMOVING SNAGS AND WRECKS FROM MISSISSIPPI RIVER; IMPROVEMENT OF MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS AND OF HARBOR AT ST. LOUIS, MO.; PREVENTION OF MISSISSIPPI RIVER FROM BREAKING THROUGH INTO CACHE RIVER AT BEECHRIDGE, ABOVE CAIRO, ILL.

This district was in the charge of Capt. Edw. Burr, Corps of Engineers, to November 7, 1901, and of Maj. Thos. L. Casey, Corps of Engineers, since that date. Division Engineer, Col. Amos Stickney, Corps of Engineers.

1. Removing snags and wrecks from the Mississippi River below the mouth of the Missouri River.—Before this work was begun, and for many years thereafter, the navigation of the river was seriously incommoded by numerous snags, logs, etc., which had lodged in the channel, and to which additions were made with each rise in the river. A large number of wrecked flatboats, barges, steamboats, and other river craft are found in the navigable channels and form a continual menace to life and property.

For the removal of these obstructions appropriations were made as early as 1824. The project adopted consisted of building boats suitable for removing the snags, logs, rack heaps, etc., and operating them whenever the stage of water was favorable and funds were available.

The amount expended upon this work on the reach of the river below the mouth of the Missouri prior to 1879 can not now be definitely ascertained, for the reason that during much of the time appropriations were made at irregular intervals in lump sums, to be applied to several streams as their needs or the terms of the law might require. From March 3, 1879, when the first specific appropriation was made, up to June 30, 1901, there had been expended $1,633,834.59. This expenditure made great improvement in the navigation of the river and lessened the danger to boats.

Two steel snag boats were employed in removing the obstructions to navigation between the mouth of the Missouri River and New Orleans, and during the year removed 3,907 snags, 27 drift piles, and 7 wrecks; 28,870 trees were felled and 17,857 miles in all was traversed.

An annual appropriation, not to exceed $100,000, for carrying on this work was made by the act of August 11, 1888. Under this appropriation the two snag boats will patrol the river and remove obstructions where necessary.

For recapitulation of commercial statistics reference should be made to report upon improving Mississippi River between Ohio and Missouri rivers.

Amount drawn under section 7, act of August 11, 1888	$92,639.67
June 30, 1902, amount expended during fiscal year	92,639.67
July 1, 1902, amount available for fiscal year 1902-3	100,000.00

(See Appendix X 1.)

2. Mississippi River between Ohio and Missouri rivers.—In its original condition the navigable channel of this section of the Mississippi River had a natural depth in many places of only 3½ to 4 feet at low water. The channels were divided by islands, which formed sloughs and secondary channels or chutes, through which a great deal of the volume of the flow was diverted, to the detriment of navigation.

The first effort to improve this condition began in 1872 and was continued for a number of years as appropriations were made, the works consisting of dikes and dams of brush and stone, erected with a view to confining the low-water volume to a single channel, and of revetments to hold and preserve the banks where necessary or advisable to do so.

The present project is a continuation of the plan adopted in 1881. It contemplates confining the flow of the river to a single channel having an approximate width below St. Louis of 2,500 feet, the natural width in many places being a mile or more at mean high water. This result is to be attempted by closing sloughs and secondary channels and by building out new banks where the natural width is excessive,

using for this purpose permeable dikes or hurdles of piling that collect and hold the solid matter that is carried in suspension or rolled on the bottom by the river. The banks, both old and new, are to be revetted or otherwise protected where necessary to secure permanency. Pending the completion of the permanent improvement, the low-water channel is to be improved each season by the use of dredges and other temporary expedients.

The object of the improvement is to obtain eventually a minimum depth, at standard low water, of 6 feet from the mouth of the Missouri to St. Louis, and of 8 feet from St. Louis to the mouth of the Ohio.

The original estimate of the cost of the improvement, as revised in 1883, is $16,397,500.

The total amount expended to June 30, 1902, was $9,541,368.73, exclusive of $180,000 allotted by acts to projects for improvement between the Illinois and the Missouri rivers, including Alton Harbor.

The amount expended during the fiscal year ending June 30, 1902, includes $556.50 expended for repairs to dredge plant. The total amount thus far expended for what is termed temporary channel improvements is $587,053.43, much of which has been for plant that is now on hand and available for future work. The approximate value of this plant is $209,425.81.

The result of the expenditure of this amount has been the partial improvement of the entire reach of the river from St. Louis to Cairo. During the past year there was at all times during open navigation a channel depth of 5 feet or more throughout this reach. The river attained a low-water stage of 5.9 feet below standard low water.

No funds were available for this improvement further than to care for the plant appertaining thereto, and no work was done during the past fiscal year.

With the present appliances and such others as may be developed for the temporary improvement of low-water channels, it is expected that a navigable depth of at least 6 feet will be maintained between St. Louis and Cairo during all stages, while the river is open to navigation, until the projected depth can be obtained throughout by the extension and completion of the permanent works.

It seems now certain that the procuring of satisfactory channels at all seasons of open navigation is merely a matter of providing funds in sufficient amounts to do the work economically. The local officer states that $250,000 is required annually for temporary low-water operations alone.

The river and harbor act approved June 13, 1902, appropriated $650,000 for continuing the improvement of the reach of the Mississippi River from the mouth of the Ohio to and including the mouth of the Missouri River.

Recapitulation of commercial statistics.

	1898.	1899.	1900.	1901.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Receipts and shipments at St. Louis	906,168	669,815	757,590	672,076
Transferred by ferries at St. Louis	4,033,871	5,036,730	5,218,967	5,860,592
Shipped from landings between St. Louis and Cairo	53,785	30,716	52,640	30,978
Total	4,993,824	5,737,261	6,029,197	6,563,646

July 1, 1901, balance unexpended		$156,114.21
Received for expenses of rented pile drivers		97.81
Amount appropriated by river and harbor act approved June 13, 1902		650,000.00
		806,212.02
June 30, 1902, amount expended during fiscal year:		
By vouchers	$72,332.96	
By amount paid by Auditor for War Department	50.00	
By amount reserved by Office Chief of Engineers	100.00	
		72,482.96
July 1, 1902, balance unexpended		733,729.06
July 1, 1902, outstanding liabilities		377.72
July 1, 1902, balance available		[a]733,351.34

Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902 650 000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix X 2.)

3. Harbor at St. Louis, Mo.—St. Louis Harbor is about 18 miles long and divided into two nearly equal parts by the Eads Bridge. The upper part, included between the bridge and the northern limits of the city, is about 10 miles in length.

Congress, by act approved September 19, 1890, appropriated $182,000 for improvement of this harbor.

The navigable reach between the Eads Bridge and Merchants Bridge was at that time obstructed by a number of middle bars. The project adopted for improvement of the harbor under the appropriation of 1890 provided for a contraction of the waterway between those bridges to a width of about 2,000 feet, in order to concentrate the flow upon the bars and thus cause scour to the depth desired. The contraction works consisted of a series of hurdles extending out from the Illinois shore, the object of the hurdles being to collect deposits of material brought down during floods, and thus build up a new bank out to the line desired.

This work, which was accomplished by the close of the fiscal year ending June 30, 1892, caused extensive deposits of sediment along the line of hurdles and has resulted in considerable increase in channel depth, with corresponding benefit to navigation.

Amount expended to July 1, 1902, $150,762.03.

The only work at this locality during the past year had in view the raising and strengthening of the river ends of Bischoff and Long dikes and the repairing and extending of Hurdle No. 10. A survey of the harbor was also made.

All the funds appropriated for this work have been expended.

For recapitulation of commercial statistics reference should be made to report upon improvement of Mississippi River between Ohio and Missouri rivers.

[a] Distributed under subheadings as follows:

For bank protection at Cairo, Ill., act of July 5, 1884	$2,571.70
For revetting bank opposite mouth of Missouri River, act of March 3, 1899	30,772.84
For from mouth of Ohio River to mouth of Missouri River, acts of June 6, 1900, and June 13, 1902	690,006.80
For protection of bank on Missouri side and to deepen and straighten channel at Wittenberg, Mo., act of March 3, 1899	10,000.00
	733,351.34

July 1, 1901, balance unexpended	$31,237.97
June 30, 1902, amount expended during fiscal year	31,237.97

(See Appendix X 3.)

4. To prevent the Mississippi River from breaking through into the Cache River at or near a point known as Beechridge, a few miles above Cairo, Ill.—The sundry civil act approved June 4, 1897, contains an item providing for this work which reads as follows:

For the purpose of preventing the Mississippi River from breaking through into the Cache River at or near a point known as Beach Ridge [Beechridge], a few miles north of Cairo, whereby the national cemetery at Mound City, at the mouth of the Cache River, and the marine hospital at Cairo would be in imminent danger of destruction, the sum of one hundred thousand dollars, or so much thereof as may be necessary, is hereby appropriated, to be immediately available.

The project for this work not being based upon a survey under the Engineer Department and the extent of the work contemplated being unknown, an estimate of its total cost could not be given. From a study of the conditions involved, it would seem that the object of the appropriation could best be carried out by revetting as great a length of the bank of the Mississippi River in the vicinity of Beechridge railroad station as the funds would cover.

The project for the expenditure of the amount appropriated contemplates commencing at a suitable point on the bank of the river a short distance above the nearest point to Beechridge station, building a short hurdle out into the stream to protect the head of the revetment and then revetting the banks in the usual manner down as far as the funds will suffice.

Under this project and during the previous fiscal years a hurdle 275 feet long was constructed and 9,435 linear feet of subaqueous mattress was placed. This mattress is about 130 feet wide and follows the form of construction used in this section of the Mississippi River, the upper 440 feet being built of brush and the remainder of lumber. The bank above the mattress was revetted with stone to the 33-foot stage, Cairo gauge, from the upper end to a length of 5,000 feet, and to the 25-foot stage for the remaining 4,435 feet.

During the past fiscal year no work was done. The work is in good condition.

The amount expended to June 30, 1902, was $93,569.44.

The funds available will be sufficient to complete, including work already done, about 10,000 feet of revetment to a height of about the 30-foot stage.

For recapitulation of commercial statistics reference should be made to report upon improvement of Mississippi River between Ohio and Missouri rivers.

July 1, 1901, balance unexpended	$6,430.56
July 1, 1902, balance unexpended	6,430.56
July 1, 1902, outstanding liabilities	3.50
July 1, 1902, balance available	6,427.06

(See Appendix X 4.)

OPERATING SNAG BOATS AND DREDGE BOATS ON UPPER MISSISSIPPI RIVER; IMPROVEMENT OF MISSISSIPPI RIVER BETWEEN MOUTH OF MISSOURI RIVER AND ST. PAUL, MINN., AND OF LA CROSSE HARBOR, WISCONSIN; OPERATING AND CARE OF GALENA RIVER IMPROVEMENT, ILLINOIS, AND OF ILLINOIS AND MISSISSIPPI CANAL AROUND THE LOWER RAPIDS OF ROCK RIVER, ILLINOIS.

This district was in the charge of Maj. C. McD. Townsend, Corps of Engineers. Division Engineer, Col. S. M. Mansfield, Corps of Engineers, to July 24, 1901, and Lieut. Col. O. H. Ernst, Corps of Engineers, since that date.

1. Operating snag boats and dredge boats on Upper Mississippi River.—By the river and harbor act of August 11, 1888, provision was made for operating snag boats and dredge boats on the Upper Mississippi River under a permanent appropriation, the sum so expended not to exceed $25,000 annually.

During the past fiscal year the snag boat *Colonel A. Mackenzie* was employed from July 1 to October 31, 1901, and from April 15 to June 30, 1902, removing snags and similar obstructions and otherwise assisting interests of navigation between Minneapolis and the mouth of Missouri River. Dredge *Vulcan* removed the obstructing portion of a wing dam near Teepeeota Point. Dredge *Geyser* was employed for a short time in deepening the channel through a bar in the draw of the Illinois Central Railway bridge at Dubuque. Dredge *Phœnix* removed three wrecks from the channel in vicinity of Quincy and two large bowlders in vicinity of Gregory. Dredge *Ajax* and steam-drill boat No. 6 blasted and removed a large ledge of rock in front of Fort Madison and also a few bowlders near mouth of Henderson River. Some dredging was done by the *Ajax* in Burlington Harbor.

The total amount expended for snag-boat service to June 30, 1902, was $874,584.

The total amount of freight transported on the Upper Mississippi River during the calendar year 1901 was about 2,125,000 tons, and the ton-miles 531,250,000; in 1900, 2,400,000 tons, and 600,000,000 ton-miles.

The amount expended during the fiscal year ending June 30, 1902, was $25,000.

(See Appendix Y 1.)

2. Mississippi River between Missouri River and St. Paul, Minn.—Under this head is carried on the improvement of through navigation and also such special harbor or levee work as is provided for by Congress. Systematic work was begun in 1878, and such good results have been secured as to demonstrate that with a continuance of operations under liberal appropriations the low-water channel of the Mississippi River between St. Paul and the Missouri River can be made sufficiently deep, available, and permanent to satisfy the demands of commerce.

The original condition of the channel between the Missouri River and St. Paul was such that in low stages the larger boats were unable to proceed farther upstream than La Crosse or Winona, and in many seasons at points much lower down their progress was checked or seriously hindered.

The original project for the improvement, adopted in 1879, which has not been materially changed, proposed the contraction of the

channel or waterway by means of wing and closing dams to such an extent as, by means of the scour thereby caused, to afford a channel of sufficient width and of a depth of 4.5 feet at low water, to be eventually increased to 6 feet by further contraction.

There was expended on the improvement to June 30, 1892, the sum of $10,147,801.60. At that date and for many years previous the condition of the channel was such as to permit the passage of the largest river boats at very low stages through to St. Paul.

During the past year work has been carried on by hired labor and use of Government plant between Wabasha and Bellevue, at Rock Island Rapids, and between Hannibal and the Missouri River, and under formal contract between Cassville and Le Claire and between Rock Island and New Boston. At all localities where work was performed good results were obtained.

The navigation interests are very large and important. The amount of freight carried during season of 1901, including logs and lumber, was approximately 2,125,000 tons, and the ton-miles 531,250,000, this being a decrease from 1900 of 275,000 tons freight and 68,750,000 ton-miles.

There was expended for channel improvement during the past year $110,000, and an increased depth was obtained at several localities. The maximum draft that could be carried June 30, 1902, at mean low water (stage 1.5 above extreme low water) was, as nearly as could be ascertained, 4.5 feet.

As regards the Flint Creek to Iowa River levee, for which the original approved estimate was $305,000, there has been appropriated $300,000, so that an additional $5,000 is needed to complete the work.

For Rock Island Harbor the estimate is $25,000, and $10,000 has been appropriated. The balance, $15,000, is needed to complete the improvement.

July 1, 1901, balance unexpended	$208,988.12
Amount appropriated by river and harbor act approved June 13, 1902	400,000.00
	608,988.12
June 30, 1902, amount expended during fiscal year	149,167.37
July 1, 1902, balance unexpended	459,820.75

Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	400,000.00

(See Appendix Y 2.)

3. Operating and care of Des Moines Rapids Canal and dry dock.—During the past fiscal year the Des Moines Rapids Canal was open for navigation 233 days, during which time there passed through it 867 steamboats and 126 barges, carrying 31,495 passengers, 15,632 tons of merchandise, and 6,602 bushels of grain. There also passed through the canal 40,761,204 feet B. M. of lumber, 15,100,000 feet of logs, 20,524,800 shingles, and 10,775,770 laths. This shows a decrease over previous year, chiefly in logs and lumber, high stages of water in 1902 permitting all rafts and many boats to pass over the rapids outside of the canal. The draft afforded by the canal is 5 feet at extreme low water, which may be increased to 6 feet at high stages.

The dry dock was in constant use during the whole year.

The cost of operating and care of the canal is provided for by an indefinite appropriation made by act of July 5, 1884.

The amount expended during the past year was $41,805.50.

(See Appendix Y 3.)

4. Operating and care of Illinois and Mississippi Canal around the lower rapids of Rock River at Milan, Ill.—This canal is 4¼ miles in length, surmounting a fall of 18 feet, and was formally opened to navigation April 17, 1895.

During the past fiscal year the canal was open for navigation 237 days, during which time there passed through it boats and barges aggregating 16,394 tons, carrying 1,473 tons of freight and 996 passengers, showing a marked decrease in traffic as compared with the preceding year, due to the entire closing of the coal mines.

The draft afforded by the canal is 7 feet, the locks, 3 in number, having a length of 170 feet between miter sills and a width of 35 feet.

The cost of operating and care of the canal is provided for by an indefinite appropriation made by act of July 5, 1884.

The amount expended during the past year was $11,014.93.

(See Appendix Y 4.)

5. Operating and care of Galena River improvement, Illinois.—This improvement, consisting of a lock and dam in the Galena River, was purchased by the United States in March, 1894, under provisions of act of September 19, 1890, at a cost of $100,000.

During the past fiscal year the lock was open for navigation 228 days, in which time there passed through it 986 boats and barges, carrying 4,174 passengers and 1,714 tons of merchandise. This traffic, although very small, is about double that of the previous year.

The draft that can be carried at extreme low water is 2 feet, as limited by the depth on the lower miter sill of the lock.

The cost of operating and care of the improvement is provided for under indefinite appropriation made by act of July 5, 1884.

The amount expended during the past year was $9,166.68.

(See Appendix Y 5.)

6. La Crosse Harbor, Wisconsin.—The approved project contemplates the construction of a lateral bulkhead, a cross dam, and a certain amount of filling between bulkhead and shore.

The full amount of the estimate, $17,000, has been appropriated and no further funds are asked for. The amount expended to June 30, 1902, is $13,821.05.

During 1901 the bulkhead and cross dam were completed and filling commenced; in 1902 dredged material to the amount of 84,000 cubic yards was placed within the bulkhead.

July 1, 1901, balance unexpended	$8,196.06
June 30, 1902, amount expended during fiscal year	5,017.11
July 1, 1902, balance unexpended	3,178.95

(See Appendix Y 6.)

RESERVOIRS AT HEADWATERS OF MISSISSIPPI RIVER; IMPROVEMENT OF MISSISSIPPI RIVER FROM ST. PAUL TO MINNEAPOLIS, MINN., OF RIVERS IN WISCONSIN AND MINNESOTA TRIBUTARY TO MISSISSIPPI RIVER, OF WARROAD RIVER, MINNESOTA, AND OF RED RIVER OF THE NORTH, MINNESOTA AND NORTH DAKOTA.

This district was in the temporary charge of Capt. H. M. Chittenden, Corps of Engineers, to September 30, 1901, and in the charge of Maj. R. L. Hoxie, Corps of Engineers, since that date. Division Engineer, Col. S. M. Mansfield, Corps of Engineers, to July 24, 1901, and Lieut. Col. O. H. Ernst, Corps of Engineers, since that date.

1. Mississippi River between St. Paul and Minneapolis, Minn.—In its natural condition this channel in its upper portions can only be navigated at low water by very small boats, and at higher stages the current is so swift in places as to make all navigation difficult. The improvement of this section of the river by the construction of locks and dams was inaugurated by the river and harbor act of August 18, 1894, which provided for commencing the construction of Lock and Dam No. 2, located near Meekers Island. The river and harbor act approved March 3, 1899, authorized the completion of Lock and Dam No. 2, together with Lock and Dam No. 1, under continuing appropriation, at a total cost, for both locks and dams, of $1,166,457.

A Board of Engineers in a report submitted April 22, 1901, proposed certain modifications of plan which will increase the cost of Lock and Dam No. 2 from $598,235 to $733,000.

The district engineer submitted, November 22, 1901, a revised estimate for Locks and Dams Nos. 1 and 2, in which he estimated the cost for both locks and dams at $1,466,000, or $299,543 in excess of the limit of cost fixed in the river and harbor act approved March 3, 1899. The estimate is published in House Doc. No. 164, Fifty-seventh Congress, first session, and is herewith in Appendix Z 1. The excess is due to the rise in price of material and labor since the original estimate, to unexpected difficulties encountered in the prosecution of the work, and to improvement in the type of work proposed.

The river and harbor act approved June 13, 1902, authorized and directed the Secretary of War to continue the work of improving the Mississippi River between St. Paul and Minneapolis, provided that the expenditure shall not exceed the present limit of cost until further estimate shall have been submitted and the present limit of cost extended by law.

The amount expended to June 30, 1902, was $502,669.78.

During the past year Lock No. 2 was nearly completed and the construction of the west 273 feet of Dam No. 2 about three-fifths completed.

All the lands and flowage rights required for Lock and Dam No. 1. have been acquired with the exception of about 13 acres, which have been made the subject of condemnation proceedings.

Test borings in bed of river at site of Lock and Dam No. 1 were completed in October, 1901.

No effect on the navigable channel can result until both locks and dams are completed. There are no commercial statistics to report, as steamboats can not navigate this section of the river in its present condition.

Reference to past reports.—For original project for slack-water navigation, by Major Warren, see Annual Reports of the Chief of

Engineers for 1867, page 259; 1874, page 287; 1881, page 1747. For surveys and estimates for locks and dams, by Major Allen, see Annual Report of the Chief of Engineers for 1888, page 1563. For removal of bowlders, Annual Report of the Chief of Engineers for 1891, page 2148. Revival of recommendation for slack-water navigation, Annual Report of the Chief of Engineers for 1892, page 1781. Surveys for lock at Meekers Island ordered, Annual Report of the Chief of Engineers for 1893, page 2202. Project and original estimate, Annual Report of the Chief of Engineers for 1894, page 1682. Résumé of plans and estimates for Lock and Dam No. 2, Annual Report of the Chief of Engineers for 1901, page 2298.

July 1, 1901, balance unexpended	$299,645.94
September 21, 1901, amount received on account of sales	9.00
Amount appropriated by sundry civil act approved June 28, 1902	250,000.00
	549,654.94
June 30, 1902, amount expended during fiscal year	109,438.05
July 1, 1902, balance unexpended	440,216.89
July 1, 1902, outstanding liabilities	16,421.60
July 1, 1902, balance available	423,795.29
July 1, 1902, amount covered by uncompleted contracts	17,157.00
Amount (estimated) required for completion of existing project	[a]223,579.33
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	223,579.33
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix Z 1.)

2. Reservoirs at headwaters of Mississippi River, and Mississippi River between Brainerd and Grand Rapids, Minn.—The project, adopted January, 1880, calls for the construction of 41 reservoirs in Minnesota and Wisconsin.

The object of these reservoirs is to collect surplus water, principally from precipitation of winter, spring, and early summer, to be systematically released so as to benefit navigation on the Mississippi River below the reservoir dams.

Dams have been constructed as follows: At Lake Winnibigoshish, Leech Lake, Pokegama Falls, Pine River, and Sandy Lake.

The total amount expended to the close of the fiscal year ending June 30, 1902, was $1,115,192.15. These expenditures cover cost of construction of five dams and their operating machinery, of superintendence and contingencies, of certain awards for damages, of repairs and partial renewals; also of operating the dams up to February 1, 1895.

The expenditure has resulted in benefit during the low-water season to the navigable portions of the Mississippi River from Grand Rapids, Minn., to the confluence of the Mississippi and St. Croix rivers, about 22 miles below St. Paul.

Reasons are given in the Annual Report of the Chief of Engineers for 1897, page 1681 et seq., for limiting the system to the reservoirs now actually constructed. The policy at present is to replace the present timber structures, which are annually becoming more and more

[a] The amount here given is the original estimate of $1,166,457, less the amount already appropriated, Congress not yet having authorized any increase in the limit of cost.

decayed, by permanent dams of concrete or masonry, to define by proper surveys the areas which the United States actually owns, and to acquire by purchase flowage rights over areas which, without legal right, are now annually overflowed by the operation of the reservoirs.

For original plans and surveys see Annual Reports of the Chief of Engineers for 1870, page 285; 1875, page 441; 1879, page 1206; 1881, pages 1761 and 2748; 1882, page 1830; 1885, page 1749. Report of Board of 1880, Annual Report of the Chief of Engineers for 1881, page 1763. Modifications, Annual Report of the Chief of Engineers for 1883, page 1472. Effects on low-water stages, Annual Reports of the Chief of Engineers for 1886, page 1503; 1887, page 1669. Board of 1887 disapproved extension to St. Croix, Chippewa, and Wisconsin rivers, Annual Report of the Chief of Engineers for 1887, page 1680. Description of dams, 1881, page 1763; 1883, page 1456; 1887, page 1667; 1901, page 2313. History, 1892, page 1824; 1901, page 2309. For Secretary of War regulations for operating see page 1830, report for 1896. Crevasse, Pine River reservoir, page 1844, report for 1896, and page 1813, report for 1897. Second cut in natural embankment, Pine River reservoir, page 2184, report for 1899.

Until the passage of the river and harbor act approved June 13, 1902, no work was done during the past year beyond the preparation of lists of lands affected by flowage, as shown by the completed portions of the resurvey. This act authorizes the expenditure of $10,000 on improvement of the river between Brainerd and Grand Rapids, Minn.

Organization for work provided for in the above-named act was well under way at the close of the fiscal year.

July 1, 1901, balance unexpended	$10,445.19
Amount appropriated by river and harbor act approved June 13, 1902	250,000.00
	260,445.19
June 30, 1902, amount expended during fiscal year	10,137.34
July 1, 1902, balance unexpended	250,307.85
July 1, 1902, outstanding liabilities	290.14
July 1, 1902, balance available	250,017.71

(See Appendix Z 2.)

3. Operating and care of reservoirs at headwaters of Mississippi River.—The river and harbor act of August 18, 1894, made applicable to the reservoirs at headwaters of Mississippi River, "so far as concerns their care, preservation, and maintenance," the provisions of the general appropriation for "operating and care of canals and other works of navigation, indefinite," contained in section 4 of the river and harbor act of July 5, 1884. The first allotment was made January 25, 1895, and the expenses from February 1, 1895, have been paid from the indefinite appropriation.

Amount expended to June 30, 1902	$157,657.62
Amount expended during the past year	17,576.47

During the past fiscal year repairs were made to the embankment at Lake Winnibigoshish dam for protection against damage by wave wash. The cofferdam at Leech Lake dam was raised 1 foot to facilitate the operation of the completed portion of the dam. At Sandy Lake the caving bank below the dam was revetted. The new house for dam tenders at Lake Winnibigoshish dam was completed and necessary repairs made to other buildings there and at Sandy Lake dam.

For capacities of reservoirs, maps of region, and comparison of rainfall and run-off see Annual Report of the Chief of Engineers for 1896, page 1841. For break in Pine River reservoir see Annual Reports of the Chief of Engineers for 1896, page 1844, and for 1897, page 2144. For diagram showing how much water has been stored each year in each reservoir see Annual Report of the Chief of Engineers for 1900 on "Construction of reservoirs at headwaters of Mississippi River."

(See Appendix Z 3.)

4. Chippewa River, including yellow banks, Wisconsin.—The original low-water depth did not exceed a foot and a half, and the channels were narrow; at the mouth the depth did not exceed a foot. The first examinations and surveys were made in 1874. The project included revetment of caving banks and the construction of spur dams from Eau Claire to the mouth, a distance of 56 miles. The estimated cost was $139,892.50. The estimate has been revised three times. The last (1888) is $272,487.72.

The total expenditures from the beginning, in 1877, to June 30, 1902, aggregate $201,743.85.

On June 30, 1900, the work had resulted in a 3-foot depth at the mouth and improved depths elsewhere. A depth of 3 feet exists wherever the dams are fully completed.

The river traffic at present is confined to the rafting of manufactured lumber and the running of loose logs. In 1901 the tonnage of rafted lumber was 62,000 tons and of loose logs 290,000 tons. The traffic has decreased one-half since 1893.

The maximum draft that could be carried June 30, 1901, at mean low water over the shoalest part of the river under improvement was 18 inches.

Owing to the limited amount of funds available no work was done during the past year.

Under the provisions of the river and harbor act approved June 13, 1902, further improvement of this river is abandoned.

July 1, 1901, balance unexpended	$63.77
June 30, 1902, amount expended during fiscal year	57.62
July 1, 1902, balance unexpended	6.15
July 1, 1902, outstanding liabilities	6.15

(See Appendix Z 4.)

5. St. Croix River, Wisconsin and Minnesota.—Before the improvement was begun the low-water depth in the channel above Lake St. Croix was but 2 feet on many of the bars. In Lake St. Croix and below the channel over the Hudson and Catfish bars was narrow and tortuous.

The project adopted in 1875, and amended as to cost in 1882 and 1889, contemplates removal of snags, bowlders, bars, etc., and the contraction of the low-water channel from Taylors Falls to the head of Lake St. Croix, and widening and straightening the channel where it is narrow or tortuous in Lake St. Croix by dredging and contraction works. The improvement of the harbor and water front of Stillwater, Minn., was added by the river and harbor act of June 3, 1896.

The object of the improvement is to furnish an open channel 3 feet deep from Taylors Falls to the confluence with the Mississippi River, 52.3 miles, and better harbor facilities at Stillwater. The last estimate placed the cost at $136,700.

In a report upon a preliminary examination and survey of the river from Taylors Falls to Stillwater, submitted in 1899 and printed in House Doc. No. 104, Fifty-sixth Congress, first session, and in the Annual Report of the Chief of Engineers for 1900, page 2836, a project was recommended for the annual expenditure of $1,000 "to keep the river in as good order as is needed for the small steamboat traffic which now exists or is likely to exist in the future." This project will require modification in 1904.

The amount expended to June 30, 1902, was $135,882.31.

The maximum draft that could be carried June 30, 1901, at mean low water was 3 feet at and below Stillwater and 2½ feet above Stillwater.

The tonnage passing over the river is approximately 2,000,000 tons per annum of loose logs, tows of lumber, and log rafts. A few steamboats made several irregular trips with excursionists during the season, but regular trips could not be made owing to the manipulation of Nevers dam, the river being at times too full of running logs and at others too low for navigation.

The river and harbor act approved June 13, 1902, appropriates $2,000 for this work, which it is proposed to expend in the temporary repair of dredge fleet, and, as far as practicable, in dredging the worst bars and removing obstructions during the seasons of 1902 and 1903.

July 1, 1901, balance unexpended	$891.77
Amount appropriated by river and harbor act approved June 13, 1902	2,000.00
	2,891.77
June 30, 1902, amount expended during fiscal year	274.08
July 1, 1902, balance unexpended	2,617.69
July 1, 1902, outstanding liabilities	.25
July 1, 1902, balance available	2,617.44

(See Appendix Z 5.)

6. Minnesota River, Minnesota.—For project and history, see pages 1725–1727, annual report for 1894. The closing dam at the foot of Pike Island, built in the fall of 1893, was raised 1½ feet in 1896. Since 1893 work has been confined to the improvement and maintenance of channel at mouth of river.

In 1898 this stream was dropped from the list of works in this district, but was revived by the appropriation of $1,000 in the river and harbor act of March 3, 1899, for removing bar at mouth of river, upon an estimate that $500 would be required annually for dredging on the bar.

Originally there was 1 foot of water on this bar at low water. The project provided for simple dredging. The estimated cost was $500 every year for maintenance.

The amount expended upon all projects to June 30, 1902, was $132,193.34, of which sum $692.08 was expended in 1899–1900 in removing bar at mouth.

No work was done during the past year.

The commerce consists of small pleasure launches and occasional excursion steamers.

July 1, 1901, balance unexpended	$306.66
July 1, 1902, balance unexpended	306.66

(See Appendix Z 6.)

7. Red River of the North, Minnesota and North Dakota.—For physical characteristics see Annual Report of the Chief of Engineers for 1874, page 295; 1875, page 370; 1878, page 730; 1879, page 1192. For plans of improvement see Annual Report of the Chief of Engineers for 1874, page 297; 1879, page 1191; 1881, page 1757. Revisions of project, see Annual Reports of the Chief of Engineers for 1883, page 1450; 1887, page 1712. For description of large landslide caused by Northern Pacific Railroad embankment, see Annual Report of the Chief of Engineers for 1898, page 1831.

When the improvement of this river began, the navigation of the reach from Breckenridge to Moorhead (97 miles) was difficult at all stages and impossible at low water. The second reach, from Moorhead to Grand Forks (155 miles), had a ruling depth at low water of 1.5 feet. The third reach, from Grand Forks to the boundary line of the United States (143.5 miles), had a ruling low-water depth of 2 feet. The low-water navigation of Red Lake River was obstructed by bowlders between Thief River Falls and High Landing, a distance of 35 miles, and by a bad bar at its connection with Red Lake.

The present project is the same as the original (adopted December, 1877), except that an open-channel improvement was substituted in 1886 by act of Congress for the proposed lock and dam at Goose Rapids, and the improvement of Red Lake River between Thief River Falls and Red Lake was added by the terms of the river and harbor act of Congress of June 3, 1896.

The object of the improvement is to provide an open channel on the Red River of the North from Breckenridge to the northern boundary line, 395.5 miles, as follows;

1. Breckenridge to Moorhead (97 miles), a channel capable of being navigated during high and medium stages of water.
2. Moorhead to Grand Forks (155 miles), a channel 50 feet wide and 3 feet deep at low water.
3. Grand Forks to the northern boundary line (143.5 miles), a channel 60 feet wide and 4 feet deep at low water.

Also to provide a 3-foot open-channel improvement of the Red Lake River and Red Lake from Thief River Falls to and including Red Lake, a total distance of 135 miles.

The original estimated cost was $364,598.17, increased in 1883 to $398,598.17. The estimate was revised in 1887, after Congress had substituted an open-channel improvement for lock and dam at Goose Rapids, and placed at $252,598.37. An increase of the latter estimate was authorized May 8, 1893, to $310,320. Congress in 1896 added $5,000 to the estimate of cost by attaching the improvement of Red Lake River to the project. In 1899, $4,000 of the $10,000 authorized was allotted to Red Lake River, so that the present estimate of cost is $319,320 for both rivers from the beginning of operations.

Red Lake River is under improvement as part of the Red River of the North, in accordance with the river and harbor act of June 3, 1896. It formed no part of the original project for the Red River of the North, and has never been accurately surveyed. No properly considered project for its improvement is possible without such a survey, and no reliable estimate of the cost of the improvement exists.

Beyond clearing the river of bowlders and logs, nothing should be done till an accurate survey and estimate of cost is available.

The total amount expended to June 30, 1902, including work on Red Lake River, was $302,413.60.

On June 30, 1901, the object had not been attained on the first division of the Red River of the North, which has for some years been closed against all navigation by permanent pile bridges. The Secretary of War has determined to leave these bridges as they stand, as there was no navigation affected thereby. The object was attained on the third division and on all but 13 miles of the second, but annual dredging will be needed to maintain the depth. On Red Lake River work has been confined to removing snags, bowlders, and other similar obstructions.

On the Red River of the North the expenditures for the past fiscal year were $841.52.

On Red Lake River the expenditures for the past fiscal year were $449.09.

Navigation on Red River is at present confined to comparatively short reaches north and south of Grand Forks, and consists mainly in the transportation of wheat to Grand Forks by 3 steamboats (100, 23, and 12 tons, respectively) and 10 barges. The tonnage during the year 1900 was 20,000.

On Red Lake River 2 steamers of 50 tons each and 1 of 24 tons were carrying general merchandise and passengers, the total tonnage in 1901 being 482, and 1,117 passengers. Seventy-four million feet B. M. of logs was run on the river during the year. Five steamboats are run on Red Lake towing logs, the quantity moved being about 74,000,000 feet B. M.

The maximum draft that could be carried June 30, 1901, at mean low water over the shoalest part of the river under improvement was nothing on the first division, 2 feet on the undredged 13 miles of the second division, and 4 feet on the third division of the Red River of the North, and 18 inches on Red Lake River.

Owing to the limited amount of funds available no work was done during the fiscal year 1902 beyond care of plant on both rivers.

The river and harbor act approved June 13, 1902, appropriates $10,000 for continuing improvement and for maintenance of Red River of the North and its tributaries. It is expected to expend this appropriation in the maintenance of existing improvements on Red River of the North and Red Lake River.

July 1, 1901, balance unexpended	$1,877.01
Amount appropriated by river and harbor act approved June 13, 1902	10,000.00
	11,877.01
June 30, 1902, amount expended during fiscal year	1,290.61
July 1, 1902, balance unexpended	10,586.40
July 1, 1902, outstanding liabilities	183.84
July 1, 1902, balance available	10,402.56

(See Appendix Z 7.)

8. Warroad Harbor and Warroad River, Minnesota.—The river and harbor act approved March 3, 1899, as amended by the emergency river and harbor act approved June 6, 1900, appropriated $3,000, or so much thereof as may be necessary, for improving the mouth of Warroad River, Minnesota. Under this appropriation no work was undertaken beyond making surveys, the balance of funds available having been held subject to action by Congress upon a preliminary report, plan, and estimate submitted June 6, 1900, and published in House Doc. No. 92, Fifty-sixth Congress, second session, and in the

Annual Report of the Chief of Engineers for 1901, page 2356. The estimate was $45,000 for a dredging plant and two years' expenses of running the dredge. The river and harbor act approved June 13, 1902, appropriates $45,000 for carrying on the work as indicated in the above-named report.

The maximum draft that could be carried June 30, 1902, at mean low water over the shoalest part of the mouth of the river was 4½ feet.

The amount expended to June 30, 1902, was $596.63.

The commerce into the river was 600 tons in 1899. The figures for 1900 and 1901 could not be obtained.

July 1, 1901, balance unexpended	$2,403.37
Amount appropriated by river and harbor act approved June 13, 1902	45,000.00
July 1, 1902, balance unexpended	47,403.37

(See Appendix Z 8.)

9. Survey of Red Lake and Red Lake River, Minnesota.—The survey of Red Lake and Red Lake River, Minnesota, with a view to the construction of a dam with locks at the outlet of said lake for the purpose of improving the navigation of the Red River of the North and said Red Lake River, Minnesota, and estimating the cost of said improvement, required by the river and harbor act approved March 3, 1899, was begun by Maj. Frederic V. Abbot, Corps of Engineers, and a preliminary report thereon was submitted April 27, 1900. Final report can not be made until a sufficiently prolonged record of the run-off has been secured.

The preliminary report was transmitted to Congress and printed in House Doc. No. 671, Fifty-sixth Congress, first session, and on pages 2828–2830 of the Annual Report of the Chief of Engineers for 1900. The run-off was measured during the past fiscal year until August 30, 1901, when operations were suspended, owing to exhaustion of funds.

The river and harbor act approved June 13, 1902, provides for the continuation of this survey.

The amount expended to June 30, 1902, was $4,989.85.

July 1, 1901, balance unexpended	$409.95
June 30, 1902, amount expended during fiscal year	399.80
July 1, 1902, balance unexpended	10.15
July 1, 1902, outstanding liabilities	10.15

(See Appendix Z 9.)

10. Survey of Otter Tail Lake and Otter Tail River, Minnesota.—The survey of Otter Tail Lake and Otter Tail River, Minnesota, with a view to the construction of a dam at the outlet of said lake for the purpose of improving the navigation of the Red River of the North, Minnesota, and estimating the cost of said improvement, required by the river and harbor act approved March 3, 1899, was inaugurated by Maj. Frederic V. Abbot, Corps of Engineers, and a preliminary report was submitted thereon April 27, 1900. Final report can not be made until a sufficiently prolonged record of the run-off has been secured.

The preliminary report was transmitted to Congress and printed in House Doc. No. 672, Fifty-sixth Congress, first session, and on pages 2830–2833 of the Annual Report of the Chief of Engineers for 1900.

The amount expended to June 30, 1902, was $2,146.66.

The run-off was measured during the past year.

The river and harbor act approved June 13, 1902, provides for the continuation of this survey.

July 1, 1901, balance unexpended	$1,464.39
June 30, 1902, amount expended during fiscal year	611.05
July 1, 1902, balance unexpended	853.34
July 1, 1902, outstanding liabilities	46.50
July 1, 1902, balance available	806.84

(See Appendix Z 10.)

11. Survey of Big Stone Lake and Lake Traverse, Minnesota and South Dakota.—The survey of Big Stone Lake and Lake Traverse, Minnesota and South Dakota, with a view to construct reservoirs therein for the improvement of the navigation of the Minnesota River, and an estimate of the cost of such improvements, required by the river and harbor act approved March 3, 1899, was inaugurated by Maj. Frederic V. Abbot, Corps of Engineers, and a preliminary report thereon was submitted April 26, 1900. Final report can not be made until a sufficiently prolonged record of the run-off has been secured.

The preliminary report was transmitted to Congress and printed in House Doc. No. 675, Fifty-sixth Congress, first session, and on pages 2833–2836 of the Annual Report of the Chief of Engineers for 1900.

The amount expended to June 30, 1902, was $1,869.31.

The run-off was measured during the past year.

The river and harbor act approved June 13, 1902, provides for the continuation of this survey.

July 1, 1901, balance unexpended	$3,568.18
June 30, 1902, amount expended during fiscal year	437.49
July 1, 1902, balance unexpended	3,130.69
July 1, 1902, outstanding liabilities	15.25
July 1, 1902, balance available	3,115.44

(See Appendix Z 11.)

IMPROVEMENT OF MISSOURI RIVER AT AND ABOVE SIOUX CITY, IOWA.

This district was in the charge of Capt. H. M. Chittenden, Corps of Engineers. Division Engineer, Col. S. M. Mansfield, Corps of Engineers, to July 24, 1901, and Col. Amos Stickney, Corps of Engineers, since that date.

1. Missouri River between Stubbs Ferry, Montana, and the lower limits of Sioux City, Iowa.—The river distance between the above points is 1,660 miles. By its physical characteristics this portion of the river is divided into four sections: The first, Stubbs Ferry to Greatfalls, Mont., 130 miles, is the navigable portion above the "Great Falls;" the second, Greatfalls to Fort Benton, Mont., 49 miles, is an unnavigable section, full of cataracts and dangerous rapids; the third, Fort Benton to Carroll, Mont., 172 miles, known as the "Rocky River," contains numerous rapids and rock obstructions, but has carried a heavy commerce; the fourth, Carroll to Sioux City, 1,309 miles, known as the "Sandy River," is characterized by muddy water, sand bars, and a shifting channel, with easily eroded and constantly eroding banks. Navigation is difficult at low water, due to the great width of the river in many places. The upper 158 miles of this section is intermediate in character between the "Rocky" and "Sandy" rivers.

The first work on the Missouri River above Sioux City was done

under an appropriation in the river and harbor act of August 14, 1876. The project provided for the removal of bowlders and the contraction of the channel on shoals in the Rocky River. Dredging was afterwards added.

Work has been carried on at some part of the river above Sioux City since that time.

Appropriations for works above Carroll being practically exhausted, the works have been dropped from the list of those requiring regular reports.

No project for the improvement of the river between Carroll and Sioux City by rectification has ever been adopted, nor have projects been adopted for the complete rectification of the river at localities where work has been done, the projects adopted for the expenditure of such appropriations or allotments as have been made for each locality being limited to the expenditure of the money available at the time.

At places where work has been done in this reach of the river the banks have been protected from erosion, and the destruction of much valuable property has been prevented.

The usual variation in water surface between the high and low water stages is about 9 feet, though at times it is much more.

At Bismarck Harbor.—The high-water channel above and below Bismarck was of excessive width, being divided by several bars and islands, and a serious erosion of the right bank a short distance above the bridge was in progress, the river threatening to break through into the Heart River.

The project adopted February 25, 1895, for the expenditure of the allotment of $40,000 from the appropriation of August 18, 1894, provided for the checking of this erosion by a group of dikes. Under this project seven dikes were constructed in 1895.

Under a project adopted September 29, 1896, for the expenditure of the allotment of $32,000 from the appropriation of June 3, 1896, on the right bank one dike was built below the above group and on the left bank two short dikes were built just below the bridge, and the bank was revetted for about 500 feet below the warehouse at the steamboat landing.

The project adopted May 27, 1899, for expenditure of the allotment of $40,000 from the appropriation of March 3, 1899, provides for repairing existing works, constructing a dike and revetment on the right bank above the bridge, if found necessary, and continuing downstream, so far as funds will permit, the left-bank protection below the bridge.

Under this project on the right bank the group of dikes constructed above the bridge in 1895 has been repaired and 1,913 linear feet of bank has been protected by revetment; on the left bank below the bridge 500 linear feet of bank just above the railroad warehouse and 900 linear feet of bank below the revetment constructed in 1897 have been protected by revetment.

No work was done during the past fiscal year except the repair of existing works.

To June 30, 1902, $114,265.48 had been expended at this locality, of which $1,000.70 was for maintenance of improvement.

At Pierre and Fort Pierre.—No work of improvement had been done by the Government at this locality prior to the act of August 18, 1894.

The river for about 7 miles, extending from above Pierre to below Fort Pierre, was of excessive width, being divided by numerous islands and bars. The steamboat landing at Pierre had silted up, erosion had occurred on the Pierre front below it, and the Fort Pierre front was cutting badly.

The project adopted October 23, 1894, for the expenditure of the allotment of $40,000 from the appropriation of August 18, 1894, provided for the rectification of the river at Pierre and Fort Pierre as far as the available funds would permit. Under this project, in 1895, five dikes were built in front of Fort Pierre, one dike in front of Pierre was completed and a second dike partly completed, and a dam was built closing the chute behind Marion Island.

Under a project adopted July 24, 1896, modified October 3, 1896, for the expenditure of the allotment of $40,000 from the appropriation of June 3, 1896, the second dike at Pierre was completed and a third below it begun, the Fort Pierre front was revetted from Bad River to the bluff below, the lower part of Marion Island was protected by two dikes and revetment, and the Marion Island dam was repaired.

Under the project adopted June 19, 1899, for the expenditure of $40,000 from the appropriation of March 3, 1899, the Marion Island dam has been extended 300 feet and strengthened, the head of the island has been protected by revetment, and the dam and the head of the island have been raised above extreme high water.

No work has been done during the past fiscal year except the repair of existing works.

To June 30, 1902, $119,259.61 had been expended at this locality, of which $1,028.48 was for maintenance of improvement.

At Yankton.—No work of improvement had been done by the Government at this locality prior to the act of June 3, 1896. The river in the vicinity of Yankton was of excessive width, and its channel was constantly shifting. A wide bar had formed in front of the steamboat landing.

The project adopted March 23, 1897, and revised September 3, 1897, provided for the beginning of the construction of a group of dikes on the right bank above Yankton for the purpose of restoring the steamboat landing.

Under this project six of the proposed dikes were begun.

The project adopted April 19, 1899, for the expenditure of the allotment of $40,000 from the appropriation of March 3, 1899, provides for continuing the construction of these dikes.

No work has been done during the past fiscal year except the repair of existing works.

To June 30, 1902, $70,909.09 had been expended at this locality, of which $267.40 was for maintenance of improvement.

At Elkpoint.—No work had been done at this locality prior to the act of June 3, 1896. The left bank was cutting rapidly, and it was feared by the citizens that the town was in danger, either by the direct erosion of the land between the river and town or by the river cutting into and occupying an old bed which ran by the town.

The project adopted June 22, 1899, for the expenditure of the allotment of $20,000 from the appropriation of March 3, 1899, together with the balance from the appropriation of June 3, 1896, provides for beginning the protection of the left bank opposite the town, the works

to consist of revetment and, where necessary to build out the shore line, of short permeable dikes.

Congress in the sundry civil act of June 6, 1900, directed that $10,000 additional to the amount already apportioned from the appropriation of March 3, 1899, should be expended at Elkpoint.

The project adopted June 29, 1900, for the expenditure of this additional allotment provides for the continuation of the revetment.

Under these projects 5,564 linear feet of bank has been protected by revetment.

No work was done during the past fiscal year except the repair of existing works.

To June 30, 1902, $48,754.88 had been expended at this locality, of which $909.70 was for maintenance of improvement.

Opposite Sioux City to opposite Elkpoint.—The first work done at this locality was in the years 1879, 1880, and 1882 from appropriations made for work at Sioux City. This work was experimental and was destroyed within a few years after construction.

The expenditures for this early work are included in work at Sioux City.

The project, adopted July 24, 1896, for the expenditure of the funds provided by the river and harbor act of June 3, 1896, provided for the protection by revetment of 4,270 feet of bank below the Combination Bridge, for repaving the upper bank for 300 feet above the bridge, and for protecting the head of the work by a short pile dike.

The project, adopted December 23, 1899, for the expenditure of the $25,000 appropriated by the river and harbor act of March 3, 1899, provides for protecting the right bank of the river with standard revetment used on this section of the river from Jackson Chute as far down the river as funds will permit.

Under this project 3,888 linear feet of bank has been protected by revetment.

No work has been done during the past fiscal year except repair of existing works.

To June 30, 1902, $63,611.36 had been expended at this locality, of which $185.80 was for maintenance of improvement.

At Sioux City.—No work had been done by the Government at this locality prior to 1878. The river above Sioux City was extremely unstable. Several cut-offs had occurred, causing radical changes in channel, increased slope, and a large amount of erosion on banks in the vicinity.

For the purpose of checking this erosion work was begun in 1878, under an amount appropriated by the act of June 18, 1878, and was continued in each succeeding year until 1882. The works constructed were of an experimental type, and have since been destroyed or abandoned by the river.

In 1889 a group of 9 dikes was built at the center of the Sioux City front to check a dangerous erosion and fair out the bank line. In 1895 2 dikes were built just above this group and 2 dikes of the group strengthened. In the same year, under a project for the expenditure of $40,000 appropriated by the sundry civil act of March 2, 1895, a group of 16 short dikes was built near the upper limits of the city to protect the bank there.

Under a project adopted June 10, 1897, for the expenditure of $40,000 allotted from the appropriation of June 3, 1896, the Iowa

bank from the mouth of the Floyd River to a point 7,400 feet below was protected by a revetment 824 feet in length and by 20 short pile dikes.

The project, adopted July 2, 1900, for the expenditure of the allotment of $20,000 from the appropriation of March 3, 1899, together with the small balance left over from previous appropriations, provides for revetting the river bank from the Combination Bridge downstream as far as the funds will permit.

Under this project 2,900 linear feet of revetment has been constructed.

No work has been done during the past fiscal year except repairs to existing works.

To June 30, 1902, $254,121.07 had been expended at this locality, of which $606.88 was for maintenance of improvement.

Ice harbors.—The adopted project provides for the construction of two ice harbors, which were afterwards located at Rockhaven, near Mandan, N. Dak., and on the Big Sioux River (upper limits of Sioux City) near its confluence with the Missouri.

To June 30, 1899, $42,762.75 had been expended, by which the two ice harbors had been completed.

Total expenditures.—Total expenditures on the Missouri River between Stubbs Ferry and Sioux City to June 30, 1902, except for snagging, were about $1,634,326.45, of which $3,998.96 was for maintenance of improvement. In addition about $10,000 was expended on the general river survey above Stubbs Ferry.

July 1, 1901, balance unexpended	[a]$24,153.82
Amount appropriated by river and harbor act approved June 13, 1902	100,000.00
	124,153.82
June 30,'1902, amount expended during fiscal year	17,886.22
July 1, 1902, balance unexpended	106,267.60
July 1, 1902, outstanding liabilities	1,129.53
July 1, 1902, balance available	105,138.07

(See Appendix A A 1.)

2. Improving Upper Missouri River by snagging.—In its original condition the "Sandy River" between Carroll and Sioux City was greatly obstructed by snags, and to a less extent by loose rocks.

The original project, adopted in 1890, provides for removing the obstructions and the temporary improvement of the worst shoals, at an estimated cost of $50,000 annually. The work, begun in 1891, has been continued in each subsequent year under allotments and appropriations for this purpose.

The expenditures to June 30, 1902, were $392,624.62. Three snag boats had been constructed or purchased, and had been operated as funds permitted.

The river has been kept fairly clear of snags and obstructions over the portions used by commercial boats.

[a] Increase of $223.02 over amount stated in 1901 report, explained as follows:

Amount received from Maj. W. L. Marshall, U. S. Army, September 16, 1901, on account of transfer of file case	$15.00
Restoration of amounts dropped from 1901 report, $212.39, less amount previously expended, $4.37; corrected amount	208.02
	223.02

A machine shop has been erected at the Sioux ice harbor and equipped with machinery, principally for use in repairing snag boats.

COMMERCIAL STATISTICS.

Amount of freight carried on the Missouri River above Sioux City, Iowa.

Calendar year—	Tons.	Calendar year—	Tons.
1887	13,961	1895	21,264
1888	12,895	1896	10,368
1889	16,723	1897	17,105
1890	14,072	1898	26,896
1891	14,211	1899	23,041
1892	17,292	1900	27,179
1893	19,481	1901	37,349
1894	37,936		

A new line consisting of two small steamboats plying short distances above and below Bismarck was put on in 1901 by the Bismarck, Washburn and Great Falls Railroad Company.

July 1, 1901, balance unexpended	[a]$1,619.59
June 30, 1902, amount expended during fiscal year	1,170.68
July 1, 1902, balance unexpended	448.91
July 1, 1902, outstanding liabilities	142.53
July 1, 1902, balance available	306.38

(See Appendix A A 2.)

IMPROVEMENT OF CUMBERLAND RIVER, TENNESSEE AND KENTUCKY, AND OF OBION AND FORKED DEER RIVERS, TENNESSEE.

This district was in the charge of Lieut. Col. M. B. Adams, Corps of Engineers, to July 17, 1901, in the temporary charge of Maj. John G. D. Knight, Corps of Engineers, from July 17 to September 17, 1901, and in the charge of Lieutenant-Colonel Adams since September 17, 1901.

1. Obion and Forked Deer rivers, Tennessee.—(*a*) *Obion River.*—This stream is situated in northwestern Tennessee, taking its rise in Henry and Weakley counties. It has a north and south fork that unite about 85 miles above its mouth in the Mississippi River, some 5 miles below the Missouri and Arkansas State line. The head of navigation is regarded as at Obion, Tenn., where it is crossed by the Illinois Central Railroad.

In its original condition the obstructions on this river were almost wholly drift, snags, and overhanging trees, which made navigation difficult and uncertain.

The original project was based on a survey made in 1891 (Annual Report of the Chief of Engineers for 1891, p. 2292 et seq.) and was adopted by the river and harbor act of July 13, 1892. The scope of the work was to obtain 3-foot navigation at low water by means of open-channel work, at an estimated cost of $50,000. As it was unlikely that the result aimed at could be achieved by this method,

[a] Increase of $11.88 over amount stated in 1901 report; restoration of amount dropped from 1901 report.

and as it was thought that the reasonable and proper method of improvement would be simply to keep the river free from such obstructions as would prevent navigation at medium and high stages, at an estimated annual cost of $2,500, the above project was modified accordingly, and as modified is still in force. This modified or present project was adopted June 1, 1897. On this section appropriations aggregating $23,500 have been made, of which $23,380.30 has been expended to the close of fiscal year ending June 30, 1902, of which $7,583.29 has been applied to maintenance. The expenditures have resulted in securing an improved channel from Obion, Tenn., to mouth of river. In 1893 a small steamboat, with tow, was enabled to ascend the river, the first in fifty years.

(*b*) *Forked Deer River.*—This stream carries off most of the rainfall of Carroll, Gibson, Henderson, Madison, Chester, and Crockett counties, Tenn., and empties into the Obion River 3½ miles above its mouth.

In its original condition the main stream and its branches, the North Fork and South Fork, were greatly obstructed by snags, drift, etc. The original project for this section may be said to have been adopted by the river and harbor act of August 2, 1882, and was based on a report of an examination of South Fork, dated December 16, 1880. (Annual Report of the Chief of Engineers for 1881, pp. 1489 et seq.) This project was subsequently modified by extension to include the North Fork and main stream until appropriations aggregating $25,000 were made and expended. The operations proposed were open-channel work, by which it was sought to maintain a satisfactory channel all the year round. This project was set aside in view of the fact that the result aimed at could not be accomplished by said method.

The present project, adopted July 24, 1896, based on the provisions of the act of June 3, 1896, may be said to have been modified by approval of March 27, 1899, based on act of March 3, 1899, and provides for the removal of surface obstructions by open-channel work from the improved channels of the Forked Deer River and its navigable branches (North and South forks), at an estimated annual cost of $2,000. (See Annual Report of the Chief of Engineers for 1898, p. 1873.)

Under this project as modified $8,000 has been appropriated, of which $7,907 had been expended to the close of the fiscal year ending June 30, 1902, of which $2,907 had been applied to maintenance. The expenditures have been productive of an improved channel, so that small boats drawing not more than 2½ feet can now navigate with greater ease and safety about eight months of the year.

For reasons of economy and simplification work on these streams has been consolidated and appropriations for both made as one item. (Annual Report of the Chief of Engineers for 1901, pp. 459–460.) The balances now remaining to the credit of Obion River, $119.70, and of Forked Deer River, $93, have been passed to the credit of the Obion and Forked Deer rivers as consolidated.

The commerce on these streams consists principally of timber products which reach a market by way of the Mississippi River.

Comparative statement of traffic for six years for Obion and Forked Deer rivers.

Fiscal year—	Tons.	Calendar year—	Tons.
1896	170,625	1898	116,525
1897	80,258	1899	118,622
1898	39,626	1900	214,907
		1901	26,717

July 1, 1901, balance unexpended	$2,455.27
Amount appropriated by river and harbor act approved June 13, 1902	4,500.00
	6,955.27
June 30, 1902, amount expended during fiscal year	2,242.57
July 1, 1902, balance unexpended	4,712.70
July 1, 1902, outstanding liabilities	24.50
July 1, 1902, balance available	4,688.20

(See Appendix B B 1.)

2. Cumberland River, Tennessee and Kentucky.—(a) Below Nashville (191 miles).—The Cumberland River rises in eastern Kentucky, on the western slope of the Cumberland Mountains; flows in a tortuous course of about 688 miles through eastern Kentucky, middle Tennessee, and western Kentucky, and discharges into the Ohio River near Smithland, Ky. From Point Burnside, Ky., the head of steamboat navigation, to Smithland, Ky., the distance is 518 miles by the river, 203 miles being in the State of Kentucky and 315 miles in the State of Tennessee.

From 1830 to 1840 the legislatures of Tennessee and Kentucky made several appropriations for the improvement of the navigation of the Cumberland River, but little benefit to the general condition of the river seems to have been accomplished. The Cumberland Navigation Company was incorporated by the State of Tennessee in 1846, for improving the "navigation of the Cumberland River below the town of Nashville by means of a system of locks and dams," but nothing tangible was done to carry out the proposed improvement.

In its original condition, this section of the river was considerably obstructed by rocky ledges, conglomerate, gravel and sand bars, snags, and other surface obstructions, on account of which navigation was rendered very uncertain.

From July 17, 1832, to July 7, 1838, Congress made five appropriations for improving the Cumberland River, Tennessee and Kentucky, aggregating $155,000, $20,000 of which was to be expended below Nashville and $135,000 on the river generally, but the records show that all the appropriations for the above period were expended below Nashville.

Between 1838 and 1871 no appropriations for this river were made. The original project (open-channel work), which provided specifically for operations on this section, was adopted by the river and harbor act of March 3, 1871, based on project submitted January 20, 1871. (See Annual Report of the Chief of Engineers for 1871, p. 468. See also *id.*, 1872, p. 462; 1884, p. 1646; 1887, p. 1759.) The work proposed was as follows: To excavate the bars and rock ledges to get an additional depth of water, to contract the waterways in places to get the requisite depth, to remove snags and bowlders from the main chan-

nel, and to restrain tributary streams in well-determined channels at their junction with the river.

To increase the depth of water at the shoals at the junction of the Cumberland River with the Ohio River, a Board of Engineer officers recommended the construction of a dike near Smithland, Ky., at an estimated cost of $129,600. (Annual Report of the Chief of Engineers for 1888, pp. 1626–1632.) The river and harbor act of September 19, 1890, allotted $30,000 from the appropriation for improving Cumberland River below Nashville, to be expended in improving the mouth of the river, as recommended.

Appropriations aggregating $305,000 were made and expended under the above project. The expenditures under the old project have resulted in lengthening the season of navigation by giving an increased depth at low water combined with greater security in the passage of obstructions. (Annual Report of the Chief of Engineers for 1896, p. 1907.)

The present project for improving the Cumberland River below Nashville was adopted July 13, 1892, by river and harbor act of that date.

The existing project contemplates the extension of the lock and dam system of the upper river over a considerable portion of the river below Nashville by the construction of 7 locks and dams, commencing at or near Harpeth Shoal (Lock A) and ending at Big Eddy Shoal (Lock G); the locks to be 52 feet wide and 280 feet long, with lifts varying from 8½ to 11½ feet, and aggregating some 70 feet. The project also includes the improvement of the Kentucky Chute at the mouth of the river according to the recommendation of the Board of Engineer officers, June 16, 1888 (Annual Report of the Chief of Engineers for 1888, p. 1628), the necessary channel work below Lock G, and the removal of surface obstructions, snags, logs, etc., below Nashville. The total estimated cost of the entire improvement is $1,964,500 (Annual Report of the Chief of Engineers for 1890, pp. 2151–2161.)

Inasmuch as the shoals near the mouth of Harpeth River constitute the most formidable obstruction of the Cumberland below Nashville, it is proposed to press the work on Lock A and its accessories to completion at the earliest possible date. Appropriations aggregating $430,000 have been made for this work under the new or canalized river project.

The expenditures to June 30, 1902, under this project amount to $249,706.78, of which $12,815 was for maintenance.

The condition of the work at Lock A at the present time may be briefly stated as follows: The masonry of the lock and the abutment is completed except the concrete in the head bay of the lock. Most of the stone filling for the dam, riprapping, and paving is on hand.

No work was done during the past fiscal year. It is expected that operations will be resumed on Lock A at an early date, and that they will be pushed vigorously, so that this important lock and accessories may be completed and put in use some time in 1903.

The following table shows as far as could be ascertained from available records the variations of level of water surface on the Cumberland River. In reference to Nashville, Tenn., Burnside, Ky., is 325.25 miles above; Carthage, 115.8 miles above, and Clarksville, Tenn., 66.7 miles below Nashville.

Table showing variations of level of water surface, fiscal years 1898–1902.

	Number of days—							
	2½ feet and less.	Over 2½ feet.	Over 5 feet.	Over 10 feet.	Over 20 feet.	Over 30 feet.	Over 40 feet.	Highest during year.
Burnside, Ky.:								
1898	173	192	106	35	6	3	0	32.6
1899	100	265	167	89	34	14	6	56.5
1900	185	181	95	27	3	0	0	25.5
1901	135	230	120	57	21	5	4	52.0
1902	137	228	117	62	29	9	6	58.9
Carthage, Tenn.:								
1898	142	223	126	60	23	5	0	34.1
1899	75	290	186	110	58	23	3	41.7
1900	171	195	113	57	4	0	0	22.7
1901	128	237	171	69	25	9	0	38.3
1902	144	221	143	81	38	19	8	50.4
Nashville, Tenn.:								
1898	101	264	180	94	34	15	0	38.8
1899	49	316	239	155	88	62	2	40.8
1900	145	221	165	107	16	0	0	26.1
1901	90	275	228	114	35	14	0	37.8
1902	89	276	198	127	61	20	12	46.1
Clarksville, Tenn.:								
1902[a]	47	318	227	148	97	49	24	50.6

[a] There was no gauge at Clarksville prior to December, 1900. As a general rule when stage is below 2½ feet navigation is closed. From 2½ to 5 feet navigation is uncertain. Above 5 feet stage navigation is good.

The Cumberland River below Nashville is usually navigable for all steamboats plying on it for six months in each year; for boats not drawing over 3 feet, from six to eight months, and for boats drawing 16 inches or less for the whole year. Navigation is practically closed for several months each year during low water.

As far as ascertainable, the tonnage for the calendar year 1901 aggregated 255,557 tons, having an estimated value of $3,694,428: passengers carried, 12,000.

Comparative statement of traffic for six years.

Fiscal year—	Tons.	Calendar year—	Tons.
1896	40,676	1898	120,232
1897	32,703	1899	263,608
1898	71,674	1900	407,088
		1901	255,557

July 1, 1901, balance unexpended		$875.17
Amount appropriated by river and harbor act approved June 13, 1902, as amended by act approved June 28, 1902		180,000.00
		180,875.17
June 30, 1902, amount expended during fiscal year		420.00
July 1, 1902, balance unexpended		180,455.17
July 1, 1902, outstanding liabilities		228.05
July 1, 1902, balance available		180,227.12

(*b*) *Above Nashville (357 miles).*—In its original condition this section of the river was considerably obstructed by rock reefs, ledges, snags, etc., which greatly impeded navigation.

The original scheme of improvement for this section, as modified and extended, contemplated open-channel work from Nashville, Tenn., to Cumberland Ford (Pineville, Ky.), 497 miles, at an estimated cost of $374,764, and was based on projects submitted January 20, 1871,

and February 8, 1872; see Annual Reports of the Chief of Engineers for 1871, page 468 et seq.; 1872, page 463 et seq.; also *id.*, 1875, page 796; 1877, page 594; 1879, page 1267; 1881, page 1859.

The first appropriation specifically applicable to the Cumberland River above Nashville was made by the act of August 14, 1876.

This open-channel scheme of improvement or old project resulted in giving increased depths at several of the principal obstructions, thus securing a longer and safer period of navigation. Under this project and its modifications appropriations aggregating $346,000 were made and expended.

The existing project for the canalization of the Cumberland River above Nashville is based on reports of an examination and survey in 1882 and 1883 (Annual Report of the Chief of Engineers for 1884, p. 1662 et seq.) and on the acts of September 19, 1890, and July 13, 1892; it was adopted August 5, 1886, by river and harbor act of that date. The project was modified by the adoption of larger locks than were first recommended and the estimate revised (Annual Report of the Chief of Engineers for 1891, p. 2270).

By act of September 19, 1890, Congress provided that of the general appropriation for improving Cumberland River above Nashville, $50,000 might be expended in commencing the improvement at Smith Shoals, and by acts of July 13, 1892, and August 18, 1894, it was provided that $10,000 of a like general appropriation might be used "in the improvement of the river above the town of Burnside."

This scheme of improvement proposes the construction of 23 locks and dams below Burnside and 6 locks and dams at Smith Shoals, above Burnside; and it intends to provide a complete system of lockage from Nashville, Tenn., to Rock Castle River, so as to afford a channel depth of 6 feet, the locks to be 52 feet wide and 280 feet long, with lifts varying from 10 to 12 feet, at an estimated cost of $8,500,000 (see Annual Report of the Chief of Engineers for 1896, p. 1916). Of this amount $1,895,000 has been appropriated.

The amount expended to June 30, 1902, under the present project is $1,624,760.34, of which sum $20,252.94 was expended on the Smith Shoals section in making the necessary examinations and surveys of the six locks and abutments of dams of this series, and in obtaining abstracts of title to all the sites and for contingencies, and $5,871.60 was expended in acquiring sites for locks and abutments of Dams Nos. 21 and 22, and for contingencies. But no work of construction was done either at Smith Shoals or at Locks 21 and 22.

During the past fiscal year active operations were in progress at Lock No. 1 under contract, and at Lock 5 by hired labor.

At Lock No. 1 the work of construction of lock approaches and abutment protection was completed December 27, 1901. A statement of the operations under this contract is given in Appendix B B 2 of this report. It is expected that operations will be undertaken at as early a date as practicable, and that this lock and accessories will be made operative some time in 1903.

The masonry of lock walls and abutments Nos. 1, 5, 6, and 7 is completed; Lock No. 2 will require no dam abutment, and the dam abutments of Locks 3 and 4 are still to be provided.

There is a balance of $16,875.39 applicable to Locks 21 and 22. The sites of the six locks and abutments of dams of the Smith Shoals section have been approved and authority granted to obtain the lands by voluntary purchase if practicable, otherwise by condemnation. Abstracts

of title to all the sites have been procured, the records being brought up to April 18, 1898. No further action has yet been taken to acquire any of the sites. There is a balance of $9,747.06 available for this work.

No operations for clearing the river of surface obstructions were carried on during the past year, owing to lack of funds. The annual expenditure for these open-channel operations is estimated at $5,000.

The Cumberland River is navigable usually from Nashville to Point Burnside, Ky., 325 miles, for steamboats drawing not more than 3 feet from four to six months of each year, and for boats of greater draft from two to three months. The fall is 223 feet, or about 8 inches per mile.

From Nashville to Caney Fork River (Carthage, 116 miles), the river is navigable for steamboats of 2½ feet draft from six to eight months, and for those of greater draft four or five months. Steamboats of light draft can ascend to Burkesville, 236 miles above Nashville, for from five to seven months, and larger boats four or five months.

The commerce of the Cumberland River above Nashville for the calendar year 1901, as nearly as could be ascertained, aggregated 267,211 tons, having an estimated value of $7,064,775. Passengers carried, 18,773.

Comparative statement of traffic for six years.

Fiscal year—	Tons.	Calendar year—	Tons.
1896	48,393	1898	124,518
1897	82,675	1899	294,763
1898	89,776	1900	289,218
		1901	267,211

July 1, 1901, balance unexpended	$106,990.46
Damages recovered from failing contractor's surety	450.17
Amount appropriated by river and harbor act approved June 13, 1902, as amended by act approved June 28, 1902	200,000.00
	307,440.63
June 30, 1902, amount expended during fiscal year	36,750.80
July 1, 1902, balance unexpended	270,689.83
July 1, 1902, outstanding liabilities	9,339.39
July 1, 1902, balance available	261,350.44
July 1, 1902, amount covered by uncompleted contracts	8,214.72

(See Appendix B B 2.)

3. Removing sunken vessels or craft obstructing or endangering navigation.—The steamer *W. K. Phillips*, sunk on or about December 14, 1897, on the north bank in the north chute of Dover Island, Cumberland River, was reported as dangerous to navigation September 10, 1900; report made on wreck to Chief of Engineers, September 26, 1900; removal authorized October 6, 1900, under provisions of act of March 3, 1899.

Under date of September 26, 1900, the engineer officer in charge reported that it would be economical to the Government to defer work of removal until the United States snag boat could do so in the regular season's work, clearing away obstructions in the river below Nashville. A snagging party was not sent out, owing to the failure of river and harbor legislation in 1901. However, with funds now available, it is expected to resume channel operations in the near future, when the wreck will be removed.

(See Appendix B B 3.)

IMPROVEMENT OF TENNESSEE RIVER AND ITS TRIBUTARIES.

This district was in the charge of Maj. John G. D. Knight, Corps of Engineers. Division Engineer, Col. Amos Stickney, Corps of Engineers, to July 24, 1901; Lieut. Col. Thos. H. Handbury, Corps of Engineers, from July 24, 1901, to January 15, 1902, and Col. G. J. Lydecker, Corps of Engineers, since January 15, 1902.

TENNESSEE RIVER SYSTEM.

The Tennessee River is 651 miles long, and with its principal tributaries forms a system of internal waterways capable of being navigated more than 1,350 miles by steamboats. In addition to this it is still farther navigable by rafts and flatboats for a distance of more than 1,000 miles, thus making a system of navigable waters 2,350 miles in length.

1. Tennessee River.—The improvement has been carried on in three sections, under separate appropriations. *(a) above Chattanooga, Tenn. (188 miles).*—In its original condition this part of the river was obstructed by rock reefs, bowlders, gravel bars, and snags. The depth of water on the bars varied from 10 to 30 inches at low water, and in some places the current was as great as 6 miles an hour.

The present project is to obtain, by training walls, wing dams, and dredging, a low-water channel 3 feet deep from Chattanooga to the mouth of the French Broad River. The estimated cost is $650,000. Up to June 30, 1895, the sum of $293,255.83 had been expended under a previous project. The total amount expended under the present project up to June 30, 1902, was $97,714.15.

As a result the river may be used by boats drawing 2 feet, except during periods of very low water, which usually occur in summer and autumn.

The total value of freight carried on this portion of the river during the calendar year ending December 31, 1901, was $2,604,931.

There were not sufficient funds on hand at the beginning of the past year to do any work.

The appropriation by act of June 13, 1902, will be applied to removing bars or improving shoals in the order of their interference with steamboat navigation.

July 1, 1901, balance unexpended	$51.13
Amount appropriated by river and harbor act approved June 13, 1902	50,000.00
	50,051.13
June 30, 1902, amount expended during fiscal year	21.11
July 1, 1902, balance unexpended	50,030.02
July 1, 1902, outstanding liabilities	30.02
July 1, 1902, balance available	50,000.00

(b) Chattanooga, Tenn., to Riverton, Ala. (237.3 miles).—In its original condition the channel from Chattanooga to Browns Ferry was obstructed by bars, bowlders, reefs, and rocky projections. Navigation was possible during six to nine months annually. Between Browns Ferry and Florence were the Big and Little Muscle shoals, which could be crossed at unusually high water only. Between Florence and Riverton the Colbert and Bee Tree shoals prevented navigation for six months of the year.

The present project proposes to remove obstructions by blasting and dredging at Ross Towhead, Bridgeport, Guntersville, and elsewhere, to build a canal 14.5 miles long, 70 to 120 feet wide, and 6 feet deep, past Big Muscle Shoals, a canal 1½ miles long at Elk River Shoals, a canal 3 miles long at Little Muscle Shoals on an open-river improvement, a canal 8 miles long past Colbert and Bee Tree shoals, and such improvement immediately below Chattanooga as may hereafter be determined on.

The total amount expended to June 30, 1902, was $4,637,981.56.

This expenditure had resulted in the completion of the Big Muscle Shoals and Elk River Shoals canals and their approaches, at a cost of $3,181,726.50, and in the improvement of Little Muscle Shoals by excavation and the construction of wing dams, whereby its navigation was greatly improved; but the results show that the requisite depth can not be obtained in this manner.

In like manner the Bee Tree and Colbert shoals were temporarily improved, at a cost of $62,243.41. This was before the adoption of the present project for the lateral canal, on which $729,928.45 additional has been expended.

The masonry of the lift lock at Colbert Shoals has been completed, and the right of way for the canal has been purchased and paid for.

It is proposed to apply the available balance to the construction of the upstream lock and part of the canal trunk, the work to be done under the continuous-contract system. The act of June 13, 1902, appropriated $200,000 for the work, and contained a provision that contracts might be entered into for $400,000 additional, all to be applied to continuing improvement at Colbert and Bee Tree shoals. No appropriation was made for work of improving the river between these shoals and Chattanooga.

No work of construction was done on Colbert Shoals Canal during the year, owing to exhaustion of funds.

At several localities the channel depth at low water is less than 3 feet, and at four localities it ranges from 1 to 1.8 feet.

The appropriation of March 3, 1899, provided funds for the survey of that portion of the river which had not heretofore been mapped. This portion lies between Shellmound, a short distance above Bridgeport, Ala., and the head of Browns Island, a short distance below Decatur. The total length of this part of the river is 136 miles. This survey was completed March 25, 1901, and the report thereof published in House Doc. No. 50, Fifty-seventh Congress, first session.

July 1, 1901, balance unexpended	$19,075.28
Amount appropriated by river and harbor act approved June 13, 1902	200,000.00
	219,075.28
June 30, 1902, amount expended during fiscal year	7,530.81
July 1, 1902, balance unexpended	211,544.47
July 1, 1902, outstanding liabilities	6,906.37
July 1, 1902, balance available	204,638.10
Amount (estimated) required for completion of existing project	4,927,939.81
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	350,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(*c*) *Below Riverton, Ala. (226 miles).*—This part of the river is below most of the large tributaries. It has therefore more water than the upper river, and as the width is not too great and the slope uniform and moderate, it is accessible to larger boats. The ruling depths are 3½ feet over the lower 196 miles, 2 feet above this.

The existing project is to obtain, by dredging, a channel not less than 5 feet deep and 150 feet wide, and to protect Livingston Point and Tennessee Island from erosion with a view to preserving the port of Paducah, Ky.

The total amount expended to June 30, 1902, was $275,000. The work at Livingston Point and Tennessee Island is completed and the worst obstructions have been removed from the channel.

July 1, 1901, balance unexpended	$17,748.02
Amount appropriated by river and harbor act approved June 13, 1902	19,000.00
	36,748.02
June 30, 1902, amount expended during fiscal year	17,748.02
July 1, 1902, balance unexpended	19,000.00

(See Appendix C C 1.)

2. Operating and care of Muscle Shoals Canal, Tennessee River.—Fifteen streams empty into the canal, none of them very large. Bars are constantly forming opposite their mouths, and also at the entrances to the canal. A Bucyrus dredge is kept on the canal in order to remove these bars as fast as they form.

The canal was maintained in a state of efficiency and readiness for use until the night of March 28, 1902, when a rainfall of unexampled severity for this region partially wrecked the aqueduct over Shoal Creek, broke through the bank of the canal, and caused a suspension of navigation until June 4, 1902.

The number of commercial steamboats and barges that used it during the calendar year ending December, 31, 1901, was 528, and the freight carried was 11,625 tons, worth $592,634. The number of lockages was 3,221.

The canal is 16 miles in length and has 11 locks. A railroad nearly 15 miles in length is operated in connection with the maintenance of the canal.

The amount expended on operating and care during the fiscal year ending June 30, 1902, was $76,201.22. Of this amount $13,988.21 was expended from a special allotment of $30,000 made for repairing the damage done by the storm of March 28, 1902. These repairs were still in progress at the end of the fiscal year.

(See Appendix C C 2.)

3. French Broad and Little Pigeon rivers, Tennessee.—(*a*) *French Broad River.*—This river is one of the largest tributaries of the Tennessee. It rises in North Carolina, flows generally in a westerly direction, and finally unites with the Holston River in the State of Tennessee, to form the Tennessee River.

In its original condition the river was obstructed by rock reefs, sand and gravel bars, and by bowlders, snags, and overhanging trees, and numerous islands in the river divided the water and diminished the depth in the navigable channels.

The project for its improvement is based upon a reconnaisance made about thirty years ago. It has for its object the removal of surface obstructions, the excavation of channels through reefs and bars, and

the concentration and regulation of its flow by means of wing dams and training walls, so as to secure a channel depth of 2½ feet at ordinary low water as far up as the town of Leadvale, a short distance below the mouth of the Nolichucky.

The amount expended to June 30, 1902, was $78,597.31. This expenditure resulted in the improvement of navigation below Dandridge, 50 miles from the mouth, by deepening and clearing the channel, removing natural and artificial obstructions, constructing wing dams, sills, and training walls, and revetting the bank where necessary.

The total value of freight carried on the French Broad River during the calendar year 1901 was reported to be $922,032.

(*b*) *Little Pigeon River.*—This river is formed by the junction of its east fork and south fork at Sevierville, Tenn., and flows in a northwesterly direction for about 5 miles, where it empties into the French Broad about 32 miles above Knoxville.

In its original condition it was obstructed by rock and gravel shoals and by rapids.

The project provides for the removal of the bar near the mouth of the river and the removal of the shoal below Catlettsburg so as to permit light-draft steamers to reach that place.

A channel 30 inches deep at low water has been dredged through the bar at the mouth of the Little Pigeon; the head of McCroskeys Island has been riprapped, and the dam across the island chute repaired.

It is impracticable to separate the freight carried on the Little Pigeon River from that carried on the French Broad, as the same boats are engaged in the trade, and the Little Pigeon practically amounts to an additional landing on the French Broad.

Owing to the great slope of the Little Pigeon River, it is subject to sudden and violent freshets, and these bring down coarse gravel and bowlders, which tend to re-form the two bars which now obstruct the navigable portion of it. Redredging of these bars will be necessary from time to time, and the improvement can never be considered as completed.

The river and harbor act of July 13, 1892, provided that of the $15,000 appropriated for improving French Broad River, Tennessee, $1,000 "may be used in removing bar or shoal in Little Pigeon River."

This is the only separate appropriation ever made for this river.

The navigable portion of it is so short—about 2 miles—as in reality to amount only to an additional landing for French Broad River boats.

July 1, 1901, balance unexpended	$2,467.31
Amount appropriated by river and harbor act approved June 13, 1902	15,000.00
	17,467.31
June 30, 1902, amount expended during fiscal year	1,064.70
July 1, 1902, balance unexpended	16,402.61
July 1, 1902, outstanding liabilities	355.27
July 1, 1902, balance available	16,047.34

(See Appendix C C 3.)

4. Clinch, Hiwassee, and Holston rivers, Tennessee.—(*a*) *Clinch River.*—This river rises in the Cumberland Mountains in Virginia, and after following a southwesterly course empties into the Tennessee River at Kingston, 104 miles above Chattanooga. About 230 miles of the river lies in the State of Tennessee.

In its original condition the channel was obstructed by rock reefs, sand and gravel bars, bowlders, snags, and overhanging trees.

The present project provides for channel excavations, removing surface obstructions, and the construction of wing dams and training walls, so as to secure a navigable channel 2 feet in depth at ordinary low water from the mouth of the river to Clinton, about 70 miles, and of 1½ feet in depth from Clinton to Haynes (or Walkers) Ferry, about 75 miles. From Haynes Ferry to Osborne Ford, in Virginia, a distance of 120 miles, it is proposed simply to remove the loose rock and bowlders, reduce the rock ledges, remove snags, overhanging trees, and similar obstructions, so as to assist raft and flatboat navigation at the stages at which the river is ordinarily used.

The amount expended to June 30, 1902, was $47,877.18, which had resulted in reducing many of the reefs, removing obstructions from the channel, building several wing dams and training walls, whereby the channel was so far improved as to enable the river to be used at stages 2 to 3 feet lower than before the improvement was begun.

The funds on hand will be applied to clearing the channel of obstructions.

(*b*) *Hiwassee River to the mouth of the Ocoee.*—This stream rises in the Blue Ridge in North Carolina and Georgia. It flows in a west-northwesterly direction, and enters the Tennesse River about 35 miles above Chattanooga and 48 miles below Knoxville. On examination made in 1874 the channel was found to be obstructed by rock reefs, gravel bars, snags, and overhanging trees.

In 1899 a survey was made and a report submitted by Major Kingman (see annual report for 1900, p. 3010). In this he presents the present project, which contemplates the development of a channel of not less than 116 feet wide, 30 inches mean depth, and 3 feet maximum depth between the mouth of the river and the mouth of the Ocoee River, at an estimated cost of $71,125.

No appropriations were made between 1890 and 1902; the total amount of appropriations from the first one made in 1876 to June 30, 1901, was $36,500. This was all expended in carrying out the project.

(*c*) *Holston River, Virginia and Tennessee.*—Major Kingman submitted report of survey of this river November 30, 1900. Estimates were submitted for improvement by the usual methods of regulation works and by locks and dams, but, in his opinion, the locality is not worthy of such expensive improvements at this time. He submitted an estimate of $5,000 for improvement by removal of channel obstructions and the cutting of overhanging trees. The views of the local officer were fully concurred in by the division engineer and by the Chief of Engineers. The report was transmitted to Congress and printed in House Doc. No. 218, Fifty-sixth Congress, second session, and at page 2518, Annual Report of the Chief of Engineers for 1901.

By river and harbor act of June 13, 1902, $5,000 was appropriated for the improvement of the Holston River and will be applied to the removal of channel obstructions and overhanging trees.

July 1, 1901, balance unexpended	$3,289.37
Amount appropriated by river and harbor act approved June 13, 1902	18,000.00
	21,289.37
June 30, 1902, amount expended during fiscal year	1,166.55
July 1, 1902, balance unexpended	20,122.82
July 1, 1902, outstanding liabilities	481.42
July 1, 1902, balance available	19,641.40

(See Appendixes C C 4–6.)

SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 3, 1899.

Maj. Dan C. Kingman, Corps of Engineers, submitted through the division engineer report dated March 25, 1901, on survey of the *Tennessee River from Scott Point to Lock A, Muscle Shoals Canal, embracing the reach between Bridgeport and Decatur, Ala.* He presents a plan for improvement at an estimated cost of $770,640. The report was transmitted to Congress and printed in House Doc. No. 50, Fifty-seventh Congress, first session. (See also Appendix C C 7.)

IMPROVEMENT OF OHIO RIVER BY OPEN-CHANNEL WORK AND CONSTRUCTION OF LOCK AND DAM NO. 37; OPERATING SNAG BOAT ON OHIO RIVER.

This district was in the charge of Maj. W. H. Bixby, Corps of Engineers, to January 15, 1902, and of Col. G. J. Lydecker, Corps of Engineers, since that date. Division Engineer, Col. Amos Stickney, Corps of Engineers, to July 24, 1901, and Lieut. Col. Thos. H. Handbury, Corps of Engineers, from July 24, 1901, to January 15, 1902.

1. Ohio River.—This improvement was commenced as far back as 1825, and it has been carried on ever since; its general purpose, from first to last, has been to increase the depth of the low-water channel, and to improve it in other respects for safe and convenient navigation.

The principal operations of the past fiscal year included dredging to the extent of 112,500 cubic yards in the vicinities of Evansville, Ind., Golconda and Mound City, Ill., and at Tradewater and Weston bars; rock excavation on bar at mouth of Licking River to the extent of 10,184 cubic yards; construction of a new dike 1,400 feet long near mouth of Tradewater River; extensive repairs approximating a reconstruction of the dam at Blennerhassett Island and minor repairs of other dams, and the completion of the general survey of the river down to the mouth of the Big Miami as heretofore required by Congress, special report on which is printed as House Doc. No. 336, Fifty-seventh Congress, first session (see Appendix D D 4, herewith).

Before improvement, low-water navigation over many of the bars and shoals was practically impossible for commercial purposes. As a result of improvements thus far made, fairly convenient channels with a least depth of 3 feet at ordinary low water have been provided through most of the bars and shoal stretches, but quite a number remain over which the boats can pass with a draft of only 2 feet, or even less in some places.

The commerce of the river is well known to be an extensive one, and of the greatest national importance. It varies in amount at different points and over different sections, as indicated by the following official record for the past year: In Pittsburg Harbor, at the head of the river, a freight tonnage of 10,916,489 tons, of which 8,030,413 was coal; at Davis Island lock and dam, 4.5 miles below Pittsburg, 3,450,665 tons, of which 3,307,738 was coal; at Louisville, Ky., via Louisville and Portland Canal, and over the Falls, 1,472,545 tons. Besides the above, 173 packet steamers in regular service on the river report general merchandise freight carried to the amount of 10,064,978 tons, and passengers numbering 4,304,730. There is also a considerable amount of coal contributed and handled on the lower river—that is to say, below the Falls at Louisville—of which no statistics are available in this Department.

Commerce can not derive the full benefit of improvements heretofore made because there are still many places at which the low-water depth is very much less than where such improvements exist, and the available draft for the whole river is thereby correspondingly limited. Continuous work, and operations at many places simultaneously, are necessary to effect a radical change and improvement in these conditions, and an annual expenditure of not less than $500,000 will be required for several years to come to provide such a low-water channel as is needed for the river's commerce. In order that satisfactory progress may be made, it is necessary temporarily to extend the scope of each season's work, and in order to do this well and economically a larger and better working plant should be available.

The amount expended up to the close of the fiscal year ending June 30, 1902, not including outstanding liabilities, was $6,254,258.19, of which the sum of $10,259.99 was applied during the past year to maintenance.

Ice piers.—The river and harbor act of June 13, 1902, contains items as follows:

The unexpended balances of funds appropriated by the river and harbor Acts of eighteen hundred and eighty-six, eighteen hundred and ninety, and eighteen hundred and ninety-four, for the construction of ice piers in the Ohio River at Ripley, Portsmouth, Pomeroy Center, Kerrs Run (upper Pomeroy), Hartford City, Ironton, Ashland, Middleport, and Gallipolis, may, in the discretion of the Secretary of War, be expended in rebuilding in a permanent and substantial manner the ice piers constructed at Middleport and Gallipolis.

The unexpended balance of funds appropriated by the river and harbor Act of June third, eighteen hundred and ninety-six, for the construction of ice piers in the Ohio River at Middleport, Syracuse, and at or near the mouth of Big Hocking River, may, in the discretion of the Secretary of War, be expended in constructing in a permanent and substantial manner one ice pier at or near the mouth of the Big Hocking River, such construction to include removal, as far as practicable, of the rock reef in the harbor to be formed by such pier.

Projects for expenditure of these balances were approved by the Secretary of War July 21 and 29, 1902, respectively.

July 1, 1901, balance unexpended	$237,220.85
Amount refunded July 29, 1901	3.34
Amount appropriated by river and harbor act approved June 13, 1902 (deducting $41,000 for Falls at Louisville, Ky.)	359,000.00
	596,224.19
June 30, 1902, amount expended during fiscal year, $98,462.44 less, 22.10 refunded December 27, 1901	98,440.34
July 1, 1902, balance unexpended	497,783.85
July 1, 1902, outstanding liabilities	782.71
July 1, 1902, balance available	497,001.14
July 1, 1902, amount covered by uncompleted contracts	38,580.00

(See Appendix D D 1.)

2. Lock and Dam No. 37, Ohio River.—This work was provided for a few days before the close of the fiscal year in the river and harbor act of June 13, 1902, but no work was done. The general project is published in House Doc. No. 336, Fifty-seventh Congress, first session (see Appendix D D 4, herewith); the total estimated cost is $1,050,000.

The money now available will be expended during the next fiscal year for preliminary work required for a final selection of site for the lock and dam, for purchase of lands, for detailed plans and specifications, and perhaps the work of actual construction may be commenced.

Amount appropriated by river and harbor act approved June 13, 1902 ..$100,000.00
July 1, 1902, balance unexpended 100,000.00

Amount (estimated) required for completion of existing project. 950,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902 500,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix D D 2.)

3. Operating snag boat on the Ohio River.—The condition of the channel way of the Ohio, the necessity for continuous snag-boat work, and the benefits accruing therefrom to river commerce are plainly shown by the yearly reports of obstructions removed, which obstructions, if permitted to remain, would make navigation highly dangerous at ordinary stages and hazardous at any time.

The project for removing obstructions by a properly equipped snag boat was put in operation in 1876, the boat having been completed at a cost of $125,125.24, and the expense of operating having been borne by appropriations for improving the Ohio River until 1890. The river and harbor act of September 19, 1890, provided $25,000 yearly for this purpose, and the act of June 3, 1896, increased the yearly appropriation to $50,000.

The amount expended on this work up to the close of the fiscal year ending June 30, 1902, was $356,498.47.

As far as practicable removal of obstructions is carried on whenever permitted by the stage of water and the absence of dangerous ice. The work of the snag boat, in connection with the occasional hire of other boats and the sending out of small parties when the snag boat is not available, maintains a channel as nearly unobstructed as possible, a large and important part of the work being the removal of wrecked coal barges as soon as practicable after the limit permitted by law.

During the past fiscal year the work was carried on in the usual manner, and resulted in removing the following obstructions: Nine hundred and fifty-five snags, 31,848 cubic feet rock, and 48 wrecks, which included the steamboats *Princess*, *City of Golconda*, and *Relief*.

(See Appendix D D 3.)

SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 3, 1899.

Major Bixby submitted through the Division Engineer final report, dated January 14, 1902, on survey of *Ohio River from Marietta, Ohio, to the mouth of the Big Miami River.*

Preliminary report on this subject, dated April 17, 1900, is printed in the Annual Report of the Chief of Engineers for 1900, page 3202. The general plan therein presented contemplates the construction of 21 locks and movable dams at an estimated cost of $19,950,000.

Major Bixby now presents a definite plan for construction within the limits covered by the survey of 20 locks and movable dams, numbered 19 to 38 inclusive, at an estimated cost ranging from $950,000 to $1,100,000 each, or a total of $19,950,000, the object of the proposed improvement being to provide a navigable depth of 6 feet at low water. This estimate includes the sum of $1,050,000 for a dam in the vicinity of Cullums Ripple, below Cincinnati. The report was transmitted to Congress and printed in House Doc. No. 336, Fifty-seventh Congress, first session. (See also Appendix D D 4.)

IMPROVEMENT OF HARBOR AT PITTSBURG, PA., OF ALLEGHENY RIVER, PENNSYLVANIA, OF MONONGAHELA RIVER, WEST VIRGINIA AND PENNSYLVANIA, AND OPERATING AND CARE OF DAVIS ISLAND DAM, OHIO RIVER.

This district was in the charge of Maj. Chas. F. Powell, Corps of Engineers, to December 23, 1901, and of Capt. W. L. Sibert, Corps of Engineers, since that date. Division Engineer, Col. Amos Stickney, Corps of Engineers, to July 24, 1901; Lieut. Col. Thos. H. Handbury, Corps of Engineers, from July 24, 1901, to January 15, 1902, and Col. G. J. Lydecker, Corps of Engineers, since that date.

1. Monongahela River, West Virginia.—Navigation of Monongahela River, West Virginia, was, in its original condition, impeded at high water by swift currents, the fall per mile being about 2 feet. At low stages it was obstructed by shoals and by numerous gravel and rock bars. Steamboat navigation was practicable at high stages as far upstream as Morgantown; occasionally a boat could go as far upstream as Fairmont, and downstream navigation of flats and small rafts was practicable at medium and high stages.

The original project of the above portion of the Monongahela River is dated February 5, 1872, and contemplated the construction of Locks and Dams Nos. 8 and 9. This project was completed on November 8, 1889, with the result that boats drawing 5.2 feet of water could navigate the river in low water as far upstream as Morgantown, W. Va., the river having previously been slackwatered from its mouth to Lock No. 8 by the Monongahela Navigation Company. The amount expended under this project was $436,900.

The existing project is dated February 3, 1897, and approved March 13, 1897, and provides for the construction of six locks and dams, Nos. 10 to 15, inclusive, between Morgantown and Fairmont, W. Va., at an estimated cost of $1,200,000 for the six. The amount expended under this project at the close of fiscal year ending June 30, 1902, was $372,109.83. None of this was applied to maintenance.

Condition of work at end of fiscal year ending June 30, 1902:

No. 10.—The lock proper is completed except hanging of the gates and installation of the operating machinery. The lock houses are about one-half completed. Paving and grading of grounds and slopes about nine-tenths completed. The dam is completed with the exception of a section about 133 feet long near midstream.

No. 11.—Foundation for the lock proper and six-twentieths of the masonry above foundation of lock proper are completed. No work done on dam.

No. 12.—Foundation for the lock, all of the lock above the foundation except two monoliths in river wall, drain and filling back of the land wall, a cofferdam inclosing about half of the dam, and the lower guide wall are completed. Paving of the lock grounds has been commenced.

No. 13.—Foundation for the lock proper except that for the interior miter sill, nine-twentieths of that portion of the lock above the foundation, the core wall and 20 linear feet of dam at abutment end, and the upper guard crib are completed.

No. 14.—No work done at this lock and dam.

No. 15.—Foundation for the lock is completed and 200 cubic yards of concrete placed. About three-fourths of the channel for the lower approach has been excavated. No work done on the dam.

No results in the way of increased depth or width or other facilities or advantages have resulted under the expenditure to date of the present project, and none will be obtained until the six locks and dams under construction are completed.

The usual variation of level of water surface is 22 feet.

In that portion of the river already improved by Locks and Dams Nos. 8 and 9 the volume of business has materially increased over that originally existing in this part of the river. Two daily lines of packets ply the river between Pittsburg and Morgantown, and towboats make such trips as are necessary. It is impracticable to separate the commerce in this reach of river from that below it.

More extended information is given in Annual Reports of the Chief of Engineers for 1896 and 1898, pages 2134 and 2173, respectively.

A survey of the Monongahela River between Geneva and Morgantown will be found in House Ex. Doc. No. 144, Forty-second Congress, second session, and from Morgantown to Fairmont, W. Va., in House Ex. Doc. No. 91, Forty-fourth Congress, first session.

The traffic at Dam No. 9, below Morgantown, was:

Fiscal year.	Passengers.	Freight.
		Tons. [a]
1900	21,609	57,211
1901	15,523	32,486
1902	15,796	33,181

[a] 2,000 pounds.

July 1, 1901, balance unexpended	$642,787.53
Amount appropriated by sundry civil act approved June 28, 1902	350,000.00
	992,787.53
June 30, 1902, amount expended during fiscal year	189,897.36
July 1, 1902, balance unexpended	802,890.17
July 1, 1902, outstanding liabilities	5,910.96
July 1, 1902, balance available	796,979.21
July 1, 1902, amount covered by uncompleted contracts	671,447.79

(See Appendix E E 1.)

2. Monongahela River, Pennsylvania.—That part of the Monongahela River in Pennsylvania extends from Pittsburg to the mouth of Dunkards Creek, a distance of 89 miles. In its original condition prior to 1840 it was navigable for steamboats only at high stages. A downstream navigation for light-draft flats and rafts was practicable at high and medium stages. The average fall per mile is about nine-tenths foot and the minimum discharge about 160 cubic feet per second.

In 1833 Congress provided for a survey of the river from Pittsburg to Brownsville, a distance of about 57 miles. This survey was not followed by an appropriation for improving the river, and the legislature of Pennsylvania, by act of March 31, 1836, incorporated and authorized the Monongahela Navigation Company to improve the river from Pittsburg, Pa., to the Virginia State line, a distance of 90¼ miles. This company built 7 locks and dams, producing slack water from Pittsburg to within 2 miles of the West Virginia State line.

The river and harbor act of June 3, 1896, authorized and directed

the Secretary of War to institute and carry to completion proceedings for condemnation of all the property and appurtenances of the Monongahela Navigation Company. Condemnation proceedings were had and award was made of $3,761,615.46 for the condemnation and appropriation of all the property and appurtenances of the company. The property was acquired by the United States on July 7, 1897.

The amount expended on original and modified projects prior to operations under existing project is $3,769,073.88, including the purchase money.

The existing project for the improvement is dated June 23, 1899, and approved July 2, 1899, and provides for enlargement and improvement of Lock 6, certain accessory structures at Lock 3, and for additional pieces of floating plant, at an estimated cost of $185,556.

The amount expended under this project at close of fiscal year ending June 30, 1902, was $98,645.81, none of which was applied to maintenance.

Condition of work at end of fiscal year ending June 30, 1902:

Lock 6.—All work has been completed except the turbines for lighting and power and the conduit for same and the purchase of additional lock grounds.

Lock 3.—All work contemplated has been completed.

Repair plant.—Contracts let for dredge boat and 2 dump scows and work commenced by contractors. Repair steamer with snagging appliances not yet contracted for.

The act of June 13, 1902, provides for the rebuilding of Lock and Dam No. 2 at a cost not to exceed $655,961, $200,000 of which is available. The project for this was submitted June 26, 1902.

Usual variations of level of water surface, 25 feet.

The aggregate tonnage of freight, principally coal, including iron and miscellaneous articles, on the river for ten years was as follows:

Calendar year—	Tons.	Fiscal year—	Tons.
1892	4,163,304	1898	6,117,973
1893	4,142,644	1899	6,954,955
1894	4,918,089	1900	5,994,975
1895	4,555,703	1901	6,856,507
1896	5,989,159	1902	9,100,887

The traffic of the river is hampered and restricted by insufficient capacity and conveniences at the locks. This will probably be overcome in the project to be adopted in rebuilding and modernizing some of the lower locks and dams.

A history of the slack-water system of this river and an estimate of the cost of its enlargement and improvement to afford adequate accommodations for a large and growing traffic are given in Annual Report of the Chief of Engineers for 1897, pages 2412–2424, inclusive.

A report upon the commercial value and importance of the works of the Monongahela Navigation Company is printed in House Ex. Doc. No. 112, Forty-ninth Congress, second session, and in Annual Report of the Chief of Engineers for 1887, page 1802.

A report of the Chief of Engineers on the subject of acquiring by purchase the locks and dams on Monongahela River, Pennsylvania, can be found in House Ex. Doc. 249, Fifty-third Congress, third session. Testimony relative to value of improvement of Monongahela Navigation Company and to commercial importance of free navigation of said river can be found in House Doc. 78, Fifty-fourth Congress, first session, reprinted in the Annual Report of the Chief of Engineers for 1896, page 2142.

July 1, 1901, balance unexpended	$102,320.22
Amount appropriated by river and harbor act approved June 13, 1902	200,000.00
	302,320.22
June 30, 1902, amount expended during fiscal year	12,567.09
July 1, 1902, balance unexpended	289,753.13
July 1, 1902, outstanding liabilities	123.85
July 1, 1902, balance available	289,629.28
July 1, 1902, amount covered by uncompleted contracts	26,940.00
Amount (estimated) required for completion of existing project	455,961.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	455,961.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix E E 2.)

3. Operating and care of locks and dams, Monongahela River.—The slack-water system of the Monongahela River comprises 9 dams and 13 locks. Locks 1 to 4 are double locks; 5 to 9 are single locks. The chambers of the large locks are 56 feet wide and the shortest of these is 216 feet long in the clear. The chambers of the small locks are 50 feet wide and 160 feet long in the clear. Controlling depths on sills at the different locks at pool surfaces vary from 4 to 6.7 feet. During low stages of water a depth of 8 feet is maintained below Dam 4 by placing flashboards on the dams, and a depth of 6 feet above that point by placing flashboards on Dams 4, 5, and 6.

The original condition and scope of this improvement is described in the preceding summary report for improving Monongahela River, Pennsylvania.

The existing project is the operating and maintaining of locks and Dams 1 to 9, inclusive.

The amount expended up to June 30, 1901, was $737,538.35.

The locks were operated throughout the year except that Lock No. 1 was closed six days for repairs; Lock No. 2, nine days; Lock No. 3, three days; Lock No. 4, twelve days, and Lock No. 8, seven days. The walls at all the locks were flooded from three to thirteen days, and navigation in pools 3 to 9, inclusive, was closed by ice from five to forty-four days.

More or less work of repair or renewal at the various locks and dams was done. Four new lock gates were constructed and placed at Locks 2 and 4. Seventy-seven thousand two hundred and seventy-five cubic yards of material was dredged at lock entrances or in pool channels. Six hundred and thirty-nine snags or stumps, a sunken flat, a sunken wharf boat, and a number of condemned crib piers were removed from the pools above Pittsburg Harbor.

The amount expended during fiscal year ending June 30, 1902, for operating and care of the locks and dams was $191,916.23.

COMMERCIAL STATISTICS.

Fiscal year.	Aggregate number of lockages.	Maximum at any dam.	
		Products.	Passengers.
		Tons.[a]	*Number.*
1898	80,885	6,117,973	157,098
1899	84,230	6,954,955	163,245
1900	75,834	5,991,975	192,652
1901	77,986	6,856,507	186,762
1902	80,753	[b]8,112,082	181,527

[a] 2,000 pounds.
[b] The coal item in this total is that passed through Lock No. 3; the coal mined in first and second pools added to 8,112,082 gives the total commerce of the river, viz, 9,100,887 tons.

(See Appendix E E 3.)

4. Harbor at Pittsburg, Pa.—This harbor comprises that portion of the Ohio River lying above Davis Island dam, a length of 4.7 miles; that portion of the Allegheny River lying between its mouth and Brilliant Station, Allegheny Valley Railroad, a length of 7.3 miles, and that portion of the Monongahela River lying between its mouth and McKeesport, a distance of 15.5 miles. Total length of harbor, 27.5 miles. That portion of the harbor most used as such, and called the lower harbor, lies between the Davis Island dam and Dams No. 1, on the Allegheny and Monongahela rivers, and measures 8 miles of river. In its original condition the lower-harbor depths were from 3 to 4 feet on natural mean low river, and very often still lower stages caused suspension of navigation.

Since the completion of Davis Island dam, in 1885, the maximum draft which could be carried over the shoalest place was scant 8 feet at pool stage. Parts of the channel are from 10 to 12 and from 16 to 20 feet in depth. The average widths of the harbor at pool surfaces are: On the Ohio about 1,100 feet; on the Allegheny about 930 feet, and at different parts of the Monongahela from about 750 to 950 feet. The capacity of the harbor is impaired by shoal places and high dumps projecting from the banks. The use for harbor purposes of that portion of the harbor in the Allegheny River is practically nullified by the low bridges in that stream. The clear height of the bridge at the mouth of the Allegheny is 35.5 feet above pool surface. The least height, with chimneys down, of the packets that ply between Pittsburg and points on the Ohio, Kanawha, and Muskingum rivers is 45 feet. The average height of the Ohio River towboats, with chimneys down, is 50 feet. The result is that practically none of the coal and iron or steel products intended for Southern shipments is loaded or harbored in the Allegheny River. When the Herr Island dam is completed the clear height of the lowest bridge on the pool created thereby will be 27.7 feet and the height of a packet suitable to the business of such a stream is 33 feet with chimneys down.

In 1858 the State of Pennsylvania, through a board of commissioners, made a detailed survey of the rivers at and near Pittsburg, and laid down on the maps high and low water lines, and marked such lines on the ground by monuments. No means, however, were provided for preserving the monuments nor for preventing the filling of the river riverward of these lines.

In 1894 a Board of Engineer officers recommended certain harbor

lines for the harbor of Pittsburg from the Davis Island dam to Brilliant and to Homestead. The recommended lines generally followed the actual banks as they existed at the time. These lines were approved by the Secretary of War January 29, 1895. An extension of these lines on the Monongahela River from Homestead to McKeesport was approved by the Secretary of War April 3, 1902.

The original and existing project for improvement is dated June 23, 1899, was approved July 11, 1899, and provided for dredging a channel through the lower harbor (below Dams No. 1 on the Allegheny and Monongahela rivers), where needed, 10 feet deep at pool, and 500 feet wide below Smithfield Street Bridge, Monongahela River, and above this bridge and in the Allegheny River of a less width and one limited by lines from ends of channel spans of adjoining bridges; for raising the old riprap dam across Brunot Island channel, Ohio River; for removing abandoned structures and unauthorized and obstructive fillings projecting from the banks beyond the harbor lines; for marking of harbor lines, and for inspecting and patrolling the harbor; all at an estimated cost of $110,662.90, exclusive of maintenance after the first year of $10,000 annually.

The amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1902, not including outstanding liabilities, was $73,633.71. None of this was applied to maintenance.

Condition of work at end of fiscal year ending June 30, 1902: The project for dredging a channel on the Monongahela River has been finished from Lock No. 1 to the Pan Handle Railroad bridge. From this bridge downstream to Market street, of the required channel, 500 feet in width, 300 feet has been made. In the Allegheny River near its mouth a channel 1,200 feet long and 180 feet wide has been made. By directing the work of sand dredgers operating under permits of the Secretary of War a channel was made through Garrison Bar, Allegheny River, about 1,200 feet long and 150 feet wide, and by the same means a channel through a shoal in the upper end of the Ohio River was improved. The raising of the dam at Brunot Island has been completed. The harbor lines on the Monongahela River have been completely marked on both banks from the mouth of the river to the Pittsburg and Lake Erie Railroad bridge at Homestead. Above this the lines have been marked on the ground at places where most needed. On the Allegheny River the lines have been marked from the Sixteenth Street Bridge to the Sharpsburg bridge and at some other places where most urgent. Surveys for establishment of points from which to locate harbor lines have been made on the Ohio River from Davis Island dam to foot of Brunot Island.

The maximum draft that could be carried June 30, 1902, at pool-full stage over the shoalest part of the locality under improvement is 10 feet. The usual variation of level of water surface is 20 feet.

The principal commercial uses of the harbor are the mooring of coal fleets awaiting a rise in the Ohio for proceeding to destination on that river or on the Lower Mississippi, the mooring of timber rafts and boat bottoms coming down the Allegheny River on rises, the delivery of coal and other materials to mills, furnaces, steel plants, and yards, and the accommodation of the several packet lines plying on the three rivers, and whose routes terminate at the harbor. Besides, coal, steel rails, cotton ties, sheet iron, wire, nails, etc., are shipped by barges in considerable quantities.

COMMERCIAL STATISTICS.

Calendar year.	Products.	Passengers.
	Tons.[a]	*Number.*
1900	8,141,451	844,415
1901	10,916,489	817,800

[a] 2,000 pounds.

More extended information as to establishment of harbor lines at Pittsburg is given in Annual Report of the Chief of Engineers for 1895, page 2420; modification of harbor lines on Monongahela River in Annual Report of the Chief of Engineers for 1896, page 2215; and in Ohio River at Allegheny City in Annual Report of the Chief of Engineers for 1899, page 2449; project for dredging, marking harbor lines, inspection, surveys at Pittsburg Harbor in Annual Report of the Chief of Engineers for 1899, page 2399.

July 1, 1901, balance unexpended	$61,212.88
Amount appropriated by river and harbor act approved June 13, 1902	10,000.00
	71,212.88
June 30, 1902, amount expended during fiscal year	24,183.69
July 1, 1902, balance unexpended	47,029.19
July 1, 1902, outstanding liabilities	1,078.56
July 1, 1902, balance available	45,950.63
July 1, 1902, amount covered by uncompleted contracts	2,066.67

(See Appendix E E 4.)

5. Operating and care of Davis Island dam, Ohio River, near Pittsburg, Pa.—This dam is a movable dam and is the first of a series for the improvement of the upper portion of the Ohio River. The chamber of the lock is 110 feet wide and 600 feet long in the clear. The improvement was completed in 1885 at a cost of about $910,000. The dam was built to secure a low-water depth of 6 feet, and has proved of great benefit to commere in general, and especially to coal interests, by allowing the harborage of coal at Pittsburg in large quantities while awaiting stages of water suitable to the passage of boats down the river.

The existing project is the operating and maintenance of the Davis Island dam.

The amount expended up to June 30, 1901, was $252,980.03.

The dam was down at the beginning of the year, and during the year was raised 4 times and lowered 4 times, and was up for one hundred and eighty days.

During the year new trestles for service bridge were secured. Thirty new wickets were built under contract and placed in dam. New engine for operating the lower lock gate, a duplicate of the upper lock gate engine, was received and placed in position.

Contract was entered into on July 2, 1901, with Robert A. Cummings, of Owensboro, Ky., for rebuilding about 600 feet length of upper guide wall. The wall has been built complete a length of 322 feet.

Contract was entered into on July 1, 1901, with the Evansville Contract Company, Evansville, Ind., for rebuilding about 250 feet length

of lower guide wall. The only work accomplished at the end of the year was the construction of the cofferdam and the removal of the old wall for a length of 90 feet.

The amount expended during fiscal year ending June 30, 1902, for operating and care of Davis Island dam was $45,299.61.

Commerce passing Davis Island dam.

Calendar year.	Freight.
	Tons.[a]
1901	3,450,665

[a] 2,000 pounds.

(See Appendix E E 5.)

6. Locks and dams at Herr Island, head of Six-mile Island, and at Springdale, Allegheny River.—Prior to the completion, in 1885, of the Davis Island dam in the Ohio River, 5 miles below its head, it was impossible to navigate the Allegheny River with steam craft of lightest draft during low-water periods, which frequently continued for months at a time. Since then a navigable depth of 8 feet has been afforded by that dam, when raised, to Garrison Ripple, 2 miles up the stream. Herr Island dam, located one-half mile below Garrison Ripple, was designed to extend slack-water navigation about 4 miles, to the city limits of Pittsburg, and at the same time form the first step toward the radical improvement of the Allegheny.

The original project, adopted September 29, 1890, contemplated a lock and fixed dam, but the dam was subsequently changed to a movable one at the request of various local interests. The then estimated cost of the improvement was $600,000, exclusive of cost of site for which $32,689.25 was paid.

The river and harbor act of June 3, 1896, provided for the further extension of slack water to Natrona, 22 miles above Herr Island dam, by the construction under continuing contracts of 2 additional locks and dams at a limiting cost, including the completion of Herr Island dam, of $1,132,000.

Under the general project approved March 13, 1897, it was provided that Dams Nos. 2 and 3 should be fixed timber structures and the locks concrete. The lock at Herr Island is also of concrete construction; the Herr Island dam comprises a 500-foot navigable pass of Chanoine wickets and 2 bear-trap weirs each 94 feet long.

At Herr Island the lock and navigable pass of dam have been built, the foundations, piers, etc., for weirs under contract have been practically finished, and the bear-trap gates under contract are well under way. For Lock No. 2 the necessary land for site has been acquired. Owing to long delay in securing the land the contract made in 1897 for this work was abrogated. At Dam No. 3 the lock under contract has been built, and the dam and abutment about one-fifth constructed.

The expenditures on the works to the close of the year ending June 30, 1902, were $702,744.71.

From what has already been done on these improvements, navigation has not derived any benefit by way of increased depth, etc., nor will it do so until one or more of the works are completed.

For the calendar year 1901 the commerce on that part of the river under improvement for slack-water navigation was approximately

2,200,000 tons of freight and 50,000 passengers, a gain of 588,897 tons of freight and 13,475 passengers over that reported for 1900.

In report printed in House Doc. No. 371, Fifty-seventh Congress, first session, it was estimated that the completion of this project will cost $148,732 more than the limiting cost fixed by Congress. This report is herewith in Appendix E E 6.

July 1, 1901, balance unexpended	$436,199.63
Amount appropriated by sundry civil act approved June 28, 1902	118,500.00
	554,699.63
June 30, 1902, amount expended during fiscal year	125,444.34
July 1, 1902, balance unexpended	429,255.29
July 1, 1902, outstanding liabilities	5,233.59
July 1, 1902, balance available	424,021.70
July 1, 1902, amount covered by uncompleted contracts	152,404.41

(See Appendix E E 6.)

7. Allegheny River, Pennsylvania.—In its original condition the Allegheny River abounded in obstructions such as bowlders, snags, islands, bars, and wide-spreading shoals, all of which rendered navigation at best hazardous, and practicable only at such high stages of water as would enable craft to clear the obstructions. Necessarily this condition resulted in frequent losses to river interests, and because of these obstructions navigators were deprived of a considerable portion of what should have been the navigable period.

The project adopted in 1878 and 1880, and which still continues, contemplated only the removal of the bowlder and snag obstructions, and the construction of low dams and dikes to close secondary channels and concentrate the low-water flow on shoals.

The amount expended under this project to the close of the year ending June 30, 1902, was $249,059.08, fully one-half of which was applied to maintenance. The work done has not increased the depth of water, generally speaking, except where dikes or dams have been built, but the removal of the obstructions has made it possible to utilize the entire flow of the stream, so that now navigators may operate safely on from 1 to 2 feet lower stages than formerly.

The present condition of the channel is generally satisfactory, having been largely cleared of the more objectionable obstructions. But to maintain this condition it is necessary to annually remove any bowlders or snags brought in by the tributaries or carried along by ice and freshets. The dikes and dams are also becoming old and require frequent repairs.

During the past fiscal year, owing to the depleted condition of the appropriation, only slight repairs were made on two structures for their temporary maintenance.

Except on the lower 25 miles of river the principal traffic consists in the downstream transportation of timber and lumber rafts, new coal-boat bottoms, barges, and flats, usually loaded with tan bark, hay, lumber and other timber products, and the towage of gravel, sand, stone, etc. Steamboating above Kittanning is gradually falling off, principally because of the obstructive low bridges along this section. The tonnage reported on the portion of the river above slack-water improvements in progress was, for the calendar year 1901, 425,000 tons, and number of passengers 10,000. The tonnage of freight for 1900 was 440,000.

Results bearing a proper relation to the expenditure for any further extended improvement of this stream can not be expected unless such improvement be accompanied by the raising of the low bridges.

July 1, 1901, balance unexpended	$2,189.56
Amount appropriated by river and harbor act approved June 13, 1902	10,000.00
	12,189.56
June 30, 1902, amount expended during fiscal year	1,248.64
July 1, 1902, balance unexpended	10,940.92
July 1, 1902, outstanding liabilities	38.83
July 1, 1902, balance available	10,902.09

(See Appendix E E 7.)

CONSTRUCTION OF LOCKS AND MOVABLE DAMS IN OHIO RIVER ABOVE CINCINNATI; IMPROVEMENT OF KANAWHA, LITTLE KANAWHA, ELK, AND GAULEY RIVERS, WEST VIRGINIA.

This district was in the charge of Capt. W. E. Craighill, Corps of Engineers. Division Engineer, Lieut. Col. Thos. H. Handbury, Corps of Engineers, to January 15, 1902, and Col. G. J. Lydecker, since that date.

1. Movable dams, Ohio River.—[This work was in the charge of Maj. W. H. Bixby, Corps of Engineers, until November 16, 1901.] A general description of the Ohio River is contained in the Annual Report of the Chief of Engineers for 1896, page 2062. The system of improvement of this river by movable dams was approved by Congress in the appropriation act for the year 1875–76 (construction of dam at Davis Island—first dam below Pittsburg). The act of September 19, 1890, provided for the construction of a dam at or near Beaver, Pa., known as No. 6. The above represent practically the original projects for the slack-water system of the Ohio. The project for Dams Nos. 2, 3, 4, and 5 is contained in House Doc. No. 209, Fifty-fourth Congress, first session (see annual report for 1896, p. 2120); that for Dams Nos. 7 to 18, inclusive, in House Doc. No. 122, Fifty-fifth Congress, third session (see annual report for 1899, p. 2361); and that for Dam No. 19 in the Annual Report of the Chief of Engineers for 1901, page 2609.

When the entire system is completed it will provide for 6-foot navigation. At present the harbor at Pittsburg is benefited alone, as the dam about 5 miles below is the only one in operation.

The cost of the locks and dams is estimated at from $850,000 to $950,000 each, although the present market prices would indicate that the work can not be accomplished within the estimate.

The following is a statement of the condition of the works:

Dam No. 2.—The masonry of lock is completed, except the resetting of a part of the stone. Work on the 500 feet of navigable pass is nearing completion.

Dam No. 3.—About four-fifths of the masonry of the lock is completed. High water and ice damaged the accepted part of this lock; the repairs are under way. The contractor for dredging a temporary channel, necessary to navigation during the work of construction, failed October 17, 1901, after removing a small amount of material. A new contract was entered into for this work.

Dam No. 4.—The masonry of lock is completed. Under contract for 500 feet of navigable pass, the cofferdam for the first 300 feet was practically completed. A temporary channel was dredged at this site for the benefit of navigation during dam construction.

Dam No. 5.—Work under contract for the lock was completed, and plans and specifications prepared for about 400 feet of navigable pass.

Dam No. 6.—Lack of funds made it necessary to close the contract for weirs, piers, etc., before completion. The act of June 13, 1902, provides for the completion of the entire work at this site.

Dam No. 13.—Under the contract for building masonry of lock but little work was done beyond the construction of the cofferdam.

Dam No. 18.—A new site for lock and dam was located, the necessary land practically acquired, and work on plans in progress.

The river and harbor act of June 13, 1902, provides for the location and commencement of construction of Locks and Dams Nos. 7, 8, 11, and 19.

The amount expended on the above works to June 30, 1902, is as follows:

Dams Nos. 2, 3, 4, and 5	$1,266,117.00
Dam No. 6	865,867.61
Dam No. 13	39,411.38
Dam No. 18	20,301.21
Total	2,191,697.20

For commercial statistics see reports for improving Ohio River and operating and care of Davis Island Dam.

CONSOLIDATED.

July 1, 1901, balance unexpended	$1,728,449.41
Amount appropriated by river and harbor act approved June 13, 1902.	1,223,000.00
Amount appropriated by sundry civil act approved June 28, 1902	46,600.00
	2,998,049.41
June 30, 1902, amount expended during fiscal year	390,146.61
July 1, 1902, balance unexpended	2,607,902.80
July 1, 1902, outstanding liabilities	5,468.76
July 1, 1902, balance available	2,602,434.04
July 1, 1902, amount covered by uncompleted contracts	643,121.26
Amount (estimated) required for completion of existing project	5,075,400.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	1,500,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

DAMS NOS. 2, 3, 4, AND 5.

July 1, 1901, balance unexpended	$1,086,937.30
Amount appropriated by river and harbor act approved June 13, 1902.	400,000.00
	1,486,937.30
June 30, 1902, amount expended during fiscal year	299,215.26
July 1, 1902, balance unexpended	1,187,722.04
July 1, 1902, outstanding liabilities	2,267.18
July 1, 1902, balance available	1,185,454.86
July 1, 1902, amount covered by uncompleted contracts	367,653.15
Amount (estimated) required for completion of existing project	1,180,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	300,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

DAM NO. 6.

July 1, 1901, balance unexpended	$60,662.90
Amount appropriated by river and harbor act approved June 13, 1902.	175,000.00
	235,662.90
June 30, 1902, amount expended during fiscal year	60,369.55
July 1, 1902, balance unexpended	175,293.35
July 1, 1902, outstanding liabilities	60.60
July 1, 1902, balance available	175,232.75

DAM NO. 7.

Amount appropriated by river and harbor act approved June 13, 1902.	$23,000.00
July 1, 1902, balance unexpended	23,000.00

DAM NO. 8.

Amount appropriated by river and harbor act approved June 13, 1902.	$300,000.00
July 1, 1902, balance unexpended	300,000.00
Amount (estimated) required for completion of existing project	550,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	200,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

DAM NO. 11.

Amount appropriated by river and harbor act approved June 13, 1902.	$300,000.00
July 1, 1902, balance unexpended	300,000.00
Amount (estimated) required for completion of existing project	550,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	200,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

DAMS NOS. 13 AND 18.

July 1, 1901, balance unexpended	$580,849.21
Amount appropriated by sundry civil act approved June 28, 1902	46,600.00
	627,449.21
June 30, 1902, amount expended during fiscal year	30,561.80
July 1, 1902, balance unexpended	596,887.41
July 1, 1902, outstanding liabilities	3,140.98
July 1, 1902, balance available	593,746.43
July 1, 1902, amount covered by uncompleted contracts	275,468.11
Amount (estimated) required for completion of existing project	1,043,400.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	800,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

DAM NO. 19.

Amount appropriated by river and harbor act approved June 13, 1902	$25,000.00
July 1, 1902, balance unexpended	25,000.00

(See Appendix F F 1.)

2. Little Kanawha River, West Virginia.—[This work was in charge of Maj. E. H. Ruffner, Corps of Engineers, until January 31, 1902.] A description of the original condition of the river and its availability for purposes of commerce is given in the Annual Report of the Chief of Engineers for 1875, page 740.

The original project provided for removing rocks, snags, overhanging and fallen trees above Burning Springs, W. Va., at a cost of $7,300, as approved by Congress on August 14, 1876. The act of Congress of June 14, 1880, made provision for the construction of a lock and dam 2 miles above Burning Springs. This lock and dam was opened to navigation on December 2, 1891, and has been maintained under the indefinite appropriation for operating and care of canals and other works of navigation.

The amount expended to June 30, 1902, is $213,246.26.

No work was done during the year. The condition of the slack-water system and the maximum draft (4 feet) that could be carried June 30, 1902, over the shoalest part of the locality under improvement, remained practically as presented in the Annual Report of the Chief of Engineers for 1900, page 489.

The $1,000 appropriated by the act of June 13, 1902, will be used in clearing the river of obstructions which have re-formed. The act also provides for an examination with a view of continuing the improvement to Burnsville.

A statement of the commerce is given in the report for operating and care of lock and dam on Little Kanawha River, West Virginia.

July 1, 1901, balance unexpended	$171.74
Amount appropriated by river and harbor act approved June 13, 1902	1,000.00
July 1, 1902, balance unexpended	1,171.74

(See Appendix F F 2.)

3. Operating and care of lock and dam on Little Kanawha River, West Virginia.—[This work was in charge of Maj. E. H. Ruffner, Corps of Engineers, until January 31, 1902.] The lock and dam, known as No. 5, was built under the appropriation for improving Little Kanawha River, West Virginia, being a part of the original project as given in the Annual Report of the Chief of Engineers for 1875, page 740.

The amount expended for operating and care of this work to June 30, 1902, is $27,070.75, of which $3,130.46 was expended during the past year.

The lock was operated during the year, and the necessary repairs were made to the lock and dam. They were both in good condition at the close of the year.

The lock and dam provide 4 feet at mean low water, but owing to the leaky condition of the dams below, owned by the Little Kanawha Navigation Company, the depth is often less.

An examination of, with a view to acquiring, the locks and dams of the navigation company is provided by the act of June 13, 1902.

The commerce that passed Lock No. 5 during the calendar year 1901 amounted to 122,190 tons, of which 110,660 tons consisted of timber and lumber; 6,260 passengers were carried.

(See Appendix F F 3.)

4. Kanawha River, West Virginia.—[This work was in charge of Maj. E. H. Ruffner, Corps of Engineers, until January 31, 1902.] A

description of the condition of the river, the projects, and the general work accomplished (the locks and dams being in operation) is contained in the Annual Report of the Chief of Engineers for 1900, page 490.

The amount expended under the original project is $50,000; that expended under the present project to June 30, 1902, is $3,985,550.28.

Work on this improvement, as provided in the modified project, is practically completed, except some channel dredging, the completion of a towboat, additions to lock houses, guard cribs at No. 3, dump boat, cisterns, drains, pavements, etc. During the past fiscal year good progress was made with the dredging; the foundations for the lock houses were completed; ten cisterns were dug, and about 85 per cent of the new towboat finished.

The river and harbor act of June 13, 1902, provides for an examination of the river from Lock No. 2 to the falls.

The maximum draft which can be carried at the shoalest part of the slack-water system at mean low water is 6 feet.

For commercial statistics see report for operating and care of locks and dams on Kanawha River, West Virginia.

July 1, 1901, balance unexpended	$182,753.95
June 30, 1902, amount expended during fiscal year	10,104.23
July 1, 1902, balance unexpended	172,649.72
July 1, 1902, outstanding liabilities	706.12
July 1, 1902, balance available	171,943.60
July 1, 1902, amount covered by uncompleted contracts	19,634.42

(See Appendix F F 4.)

5. Operating and care of locks and dams on Kanawha River, West Virginia.—[This work was in charge of Maj. E. H. Ruffner, Corps of Engineers, until January 31, 1902.] Under the projects for improving the Kanawha River 10 locks and dams were built, 2 fixed dams and 8 movable (Chanoine type), extending slack-water navigation for a distance of 90 miles from the Ohio River. The maintenance of these works is provided for by the indefinite appropriation for operating and care of canals and other works of navigation.

The location of each lock and dam, and year in which completed, is given in the Annual Report of the Chief of Engineers for 1899, page 428.

The total amount expended in operating and care of these works to June 30, 1902, is $479,167.56, of which $47,000.94 was expended during the past year.

High water and ice interrupted navigation for thirty-five days at Locks Nos. 2 and 3 (fixed dams), and the repair of gates and removal of deposit a further nine days at No. 3. The movable dams were operated without notable accident.

Owing to the length of service of most of the works on this river considerable renewal is now required, and the cost of maintenance will in the immediate future be greater than heretofore. The works were kept in good condition during the year.

The commerce for the past year is 1,547,610 tons, of which 1,370,180 tons was coal and 124,793 tons timber products, an increase of 71,680 tons over the calendar year 1901.

(See Appendix F F 5.)

6. Gauley River, West Virginia.—[This work was in charge of Maj. E. H. Ruffner, Corps of Engineers, until January 31, 1902.] A description of the conditions, project, etc., is contained in the Annual Report of the Chief of Engineers for 1900, page 494.

The amount expended to June 30, 1902, is $14,738.27.

No work was done during the year. The condition of the river and the maximum depth (2 feet) remain practically as stated in the Annual Report of the Chief of Engineers for 1901, page 489.

The commerce consists chiefly of saw logs, which are floated to the mills; during the calendar year 1901 about 1,305 tons were floated into the Kanawha River, and about 19,167 tons were floated to Camden-on-Gauley, a distance of from 11 to 28 miles.

July 1, 1901, balance unexpended	$282.93
June 30, 1902, amount expended during fiscal year	21.20
July 1, 1902, balance unexpended	261.73
July 1, 1902, outstanding liabilities	4.50
July 1, 1902, balance available	257.23

(See Appendix F F 6.)

7. Elk River, West Virginia.—[This work was in charge of Maj. E. H. Ruffner, Corps of Engineers, until January 31, 1902.] A description of the conditions, project, etc., is contained in the Annual Report of the Chief of Engineers for 1900, page 493.

The amount expended to June 30, 1902, is $30,259.12.

No work was done during the year. The maximum draft (2 feet) over the improved part remains as stated in the Annual Report of the Chief of Engineers for 1901, page 489.

The commerce of the river for the calendar year 1901 consisted principally of saw logs, railroad ties, tan bark, and lumber, amounting to 87,785 tons.

The river and harbor act of June 13, 1902, provides for an examination of the Elk River with a view to open-river navigation.

July 1, 1901, balance unexpended	$248.13
June 30, 1902, amount expended during fiscal year	7.25
July 1, 1902, balance unexpended	240.88

(See Appendix F F 7.]

IMPROVEMENT OF MUSKINGUM RIVER, OHIO, OF GUYANDOT RIVER, WEST VIRGINIA, OF BIG SANDY RIVER AND ITS FORKS, WEST VIRGINIA AND KENTUCKY, AND OF KENTUCKY RIVER, KENTUCKY.

This district was in the charge of Maj. E. H. Ruffner, Corps of Engineers. Division Engineer, Col. Amos Stickney, Corps of Engineers, to July 24, 1901; Lieut. Col. Thos. H. Handbury, Corps of Engineers, from July 24, 1901, to January 15, 1902, and Col. G. J. Lydecker, Corps of Engineers, since that date.

1. Muskingum River, Ohio.—The original condition of the waterway was as described in the Annual Report of the Chief of Engineers for 1900, page 488.

The report is limited to work carried on under an appropriation of $102,000 by act of August 11, 1888, for the construction of a lock at Taylorsville and the reconstruction of the lock at Zanesville, Ohio, and to work carried on under an appropriation of $6,000 for the repair

and extension of the levee at Zanesville, Ohio, which was included in the sundry civil act of July 1, 1898. The river and harbor act of August 18, 1894, provided for the completion of the ice-harbor lock and its appurtenances at mouth of Muskingum River, diverting for this purpose a portion of the funds remaining to the credit of the August 11, 1888, appropriation.

All the work contemplated by the original and modified project has been accomplished, except the reconstruction of the Zanesville lock, which work was indefinitely postponed by the act of Congress approved August 18, 1894. The amount expended on the project up to the close of the fiscal year ending June 30, 1902, is $106,932.51.

The minimum sill depth is the controlling mean low-water depth of the Muskingum River system. This is 6 feet at the Taylorsville lock and 3 feet at the ice-harbor lock at mouth of river. The variations of level of water surface at the two locks is from 6 feet to 24 feet above the upper sill at the Taylorsville lock and from 7.6 feet to 46 feet above the corresponding sill of the ice-harbor lock at mouth of river.

Reference is made to the Annual Report of the Chief of Engineers for 1899, pages 424 and 2454, for certain work required to complete the improvements, and the Annual Report of the Chief of Engineers for 1895, page 2390, for report of examination and survey of the Muskingum River above Zanesville, Ohio, with a view to its improvement and the restoration of a lock and dam rendered useless by decay and destruction.

The commercial statistics for this work can not be separated from the general commerce of the Muskingum River, and are reported under the head of operating and care of locks and dams on the river.

July 1, 1901, balance unexpended	$1,067.49
Amount appropriated by river and harbor act approved June 13, 1902	10,300.00
July 1, 1902, balance unexpended	11,367.49
July 1, 1902, outstanding liabilities	2.25
July 1, 1902, balance available	11,365.24

(See Appendix G G 1.)

2. Operating and care of locks and dams on Muskingum River, Ohio.—The original condition, scope of improvements, its availability for purposes of commerce, and the existing project for maintaining the improvements are given in the annual report for 1901, pages 485 and 486. A statement of the amounts and dates of all allotments for this work is given in the report of the district officer.

Up to the close of the fiscal year ending June 30, 1902, a total sum of $1,393,253.74 has been expended in general repairs and in maintaining the navigable depth and width of channels by dredging. An additional sum of $17,190.44 was expended in building a protection wall at Zanesville and altering certain bridges at Taylorsville and Marietta.

The expenditures during the fiscal year ending June 30, 1902, amounted to $48,070.11. With this sum the system has been operated and kept in repair and deposits were dredged from the channels between the locks.

The depth and width of channels remain the same as at the close of the preceding fiscal year; the maximum draft that can be carried, June 30, 1902, at mean low water over the shoalest part of the river is 5.5 feet, except at Lock No. 1 and Lock No. 4, where the minimum

sill depths are 3 feet and 5 feet, respectively. The ten locks of the system pass out of use as soon as a fixed discharge obtains at the corresponding dams; the navigable high-water line varies in height above the normal levels of the different pools from 8.7 feet at Dam No. 1 to 12 feet at Dam No. 9.

The system was in good navigable condition at the close of the fiscal year, but many parts are decayed, worn out, and must be renewed.

The total commerce for the calendar year 1901 was 81,608 tons of freight, valued approximately at $4,500,000, and 77,580 passengers.

(See Appendix G G 2.)

3. Guyandot River, West Virginia.—A description of the original condition, project, etc., is given in the Annual Report of the Chief of Engineers for 1901, pages 489, 490.

Up to June 30, 1902, $22,499.78 had been expended, resulting in the partial improvement of the river by the removal of obstructions over a distance of 119 miles.

Light-draft steamboats can run at moderate stages of water over about 80 miles and log rafts over the entire length of the improved portion of the stream, the maximum draft that could be carried June 30, 1902, at mean low water being about 20 inches.

The commerce consists almost entirely of timber, cross-ties, and staves and has increased from 61,128 tons in 1891 to 160,000 tons in 1901. A statement of this is given in detail in the report of the local officer.

COMMERCIAL STATISTICS.

Fiscal year—	Tons.	Calendar year—	Tons.
1891	61,128	1897	190,000
1892	103,800	1898	158,000
1893	162,250	1899	110,000
1894	141,221	1900	130,000
1895	247,400	1901	160,000
1896	202,000		
1897	143,300		

July 1, 1901, balance unexpended	$0.22
July 1, 1902, balance unexpended	.22

(See Appendix G G 3.)

4. Big Sandy River and Tug and Levisa forks, West Virginia and Kentucky.—In its original condition this river and its forks were much obstructed by rocks, bars, snags, and leaning trees. During the low-water period of each year navigation was practically suspended.

The original project, providing for the removal of rocks, snags, and overhanging trees from the main stream and the Levisa and Tug forks, which unite at the town of Louisa, Ky., to form the main stream, was for "improving Big Sandy River, from Catlettsburg, Ky., to the head of navigation," and was adopted in 1878. (Annual Report of the Chief of Engineers for 1875, pp. 756–769.) This improvement was for the purpose of aiding light-draft steamboat, push-boat and rafting navigation on the main river and the Tug and Levisa forks.

In 1880 the appropriations for the forks were made distinct from that for the main river, and three works resulted. At the same time the project of 1878 for the improvement of the Big Sandy proper was so modified as to provide for the construction of a lock and dam in that stream at Louisa immediately below the junction of Levisa and

Tug forks. A concurrent resolution of Congress of April 14, 1898, required surveys and the preparation of more complete plans and estimates for the improvement of the Big Sandy and the Tug and Levisa forks of same in Kentucky and West Virginia, with probable cost of same. A report was submitted and is printed as House Doc. No. 456, Fifty-fifth Congress, second session, and found on page 2159 of the Annual Report of the Chief of Engineers for 1898.

The river and harbor act of March 3, 1899, adopted a portion of the extended improvement recommended, and authorized the letting of contracts for completion of two locks and dams on the Big Sandy River, between Louisa and the mouth, at a cost not to exceed $450,000.

The river and harbor act of June 13, 1902, authorized the construction of a lock in each of the forks next above their junction, the completion of the locks and dams in the Big Sandy River, and the raising of the crest of the dam at Louisa. An appropriation of $175,000 was made, and authority for the expenditure of $175,000 additional given.

Up to June 30, 1902, the expenditures had aggregated $593,234.38, with results as follows:

Under the project for the removal of obstructions the channel had been cleared and maintained from 1878 to 1880.

Under the modified projects of 1880 and 1891 a lock and movable dam had been opened to navigation, and the river maintained in navigable condition by the removal of obstructions.

The survey provided for in the act of March 3, 1899, had been completed and the construction of two locks was well under way, the cofferdams having been completed, and a part of the river wall at each lock constructed. These locks are to be of Portland cement concrete. The dwelling, cement house, road, etc., at Lock No. 2, and cement houses at Lock No. 1, were completed, and valves and gearing and necessary cement purchased.

The maximum draft which can be carried at mean low water over the shoalest part of the river is 20 inches, and the variation of water surface at Catlettsburg is sometimes as much as 60 feet, and at Louisa as much as 40 feet.

The commerce consists of timber and farm products. The amount can not well increase until slack water has been extended by additional dams above and below the single dam now in place.

A description of original condition, project, etc., is given in the Annual Report of the Chief of Engineers for 1901, pages 493, 494.

Up to June 30, 1902, $27,679.59 had been expended on Levisa Fork, and $29,222.50 on Tug Fork, a total of $56,902.09, resulting in the material improvement of navigation, giving increased facilities for push boats at low water and rafts and steamboats at moderate stages for a distance of about 100 miles on each fork.

The work heretofore done has enabled craft drawing 20 inches to run at mean low water over the shoalest parts of the streams.

The commerce consists largely of timber, cross-ties, and staves, and varies somewhat with the condition of the rivers, being greatest during wet seasons and least during times of long-continued dry weather. In general it is about 175,000 tons for Levisa and 125,000 tons for Tug, a total of 300,000 tons. The statistics in detail are given in the report of the local office.

A continuation of the improvement of the main river should include regulating works below Dam No. 1.

COMMERCIAL STATISTICS.

Fiscal year—	Tons.	Calendar year—	Tons.
1890	268,582	1897	406,900
1891	277,303	1898	415,400
1892	455,926	1899	328,272
1893	466,723	1900	300,000
1894	297,800	1901	349,862
1895	545,910		
1896	471,382		
1897	414,500		

The above is the commerce of the three streams: Big Sandy, proper, from Louisa, Ky., to its mouth in the Ohio at Catlettsburg, Ky., a distance of 26 miles, and of Levisa and Tug forks, which unite at Louisa to form the main river.

July 1, 1901, balance unexpended	$404,210.02
Amount appropriated by river and harbor act approved June 13, 1902	178,000.00
	582,210.02
June 30, 1902, amount expended during fiscal year	88,444.40
July 1, 1902, balance unexpended	493,765.62
July 1, 1902, outstanding liabilities	828.06
July 1, 1902, balance available	492,937.56
July 1, 1902, amount covered by uncompleted contracts	156,628.77
Amount (estimated) required for completion of existing project	4,080,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	50,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix G G 4.)

5. Operating and care of lock and dam on Big Sandy River, West Virginia and Kentucky.—This lock and dam, located near Louisa, Ky., were finished during the fiscal year of 1897 under appropriations for improving Big Sandy River, West Virginia and Kentucky.

The lock has a depth of 1 foot 9 inches over the lower sill at mean low water and of 11 feet 9 inches over the upper sill at pool level. When the other dams of the series have been built the minimum depth at pool stage will be 6 feet. The lock is 52 feet wide and 190 feet long between hollow quoins. The navigable pass is 130 feet wide.

The project involves operating and care for the lock and dam with such funds as may annually be allotted.

The amount expended for this purpose to June 30, 1902, was $15,613.36, the work having continued since July 1, 1897.

On June 30, 1901, the work was in good condition and available for commerce.

The expenditures during the fiscal year ending June 30, 1902, were $3,351.87, and have resulted in keeping the work in excellent navigable condition, the buildings, walks, and grounds in repair, and in the satisfactory operation of the lock and dam.

Commercial statistics for this work are given in the report for improving Big Sandy River.

(See Appendix G G 5.)

6. Kentucky River, Kentucky.—The project was adopted in 1879 (Annual Report of the Chief of Engineers for 1879, pp. 1398–1422), at which time the five locks and dams were in bad condition and navigation was suspended because of damage to the two lower dams. These

works were built by the State of Kentucky, which not only failed to keep them in repair, but also allowed the pools to fill with snags.

The project provided for repairing the five locks and rebuilding the dams, the removal of channel obstructions, and the extension of 6-foot slack-water navigation to the Three Forks, a distance of about 261 miles from the mouth at Carrollton, Ky., where this stream joins the Ohio.

The amount expended to June 30, 1902, was $2,151,212.85, by which expenditure the original works were repaired and rebuilt and three additional locks and dams were constructed above, and a dam was built at Beattyville, Ky., which, however, being at the proposed head of navigation and not connected by slack water with the others below, has been of no benefit.

The first dam in the series is 4 miles from the Ohio, and during the extreme low water in the latter stream the depth is reduced to about 2½ feet; otherwise the minimum draft is 5.5 feet to Dam No. 9, now under construction, a distance of 158 miles, above which no boats can run at low stage.

There has been no increase in the length of navigable river during the year.

The available length of the original locks is 146 feet with 38 feet width; the new locks have an available length of 148 feet and a width of 52 feet.

The expenditure during the year ending June 30, 1902, has resulted in the completion of the cofferdam for the construction of Lock No. 9, the excavation required to begin the masonry, and the building of the lock walls to an average height of about 6 feet. The dwellings for the accommodation of the lockmen have also been completed. The land for the site of Lock and Dam No. 10 has been acquired and a contract for the construction of these works has been made.

The cost of completing the improvements projected will exceed the limit of authority ($1,349,000) under existing legislation (Annual Report of the Chief of Engineers for 1899, p. 2514). It is proposed with the amount authorized to complete Locks and Dams Nos. 10 and 11, begin the construction of No. 12, and place the pools between the dams in navigable condition by the removal of channel obstructions and timber along the shores which would be killed by the permanent raising of the water surface.

The commercial statistics will be found in the report upon operating and care of Kentucky River.

July 1, 1901, balance unexpended	$459,365.02
Amount appropriated by sundry civil act approved June 28, 1902	200,000.00
	659,365.02
June 30, 1902, amount expended during fiscal year	73,577.67
July 1, 1902, balance unexpended	585,787.35
July 1, 1902, outstanding liabilities	800.00
July 1, 1902, balance available	584,987.35
July 1, 1902, amount covered by uncompleted contracts	332,415.73
Amount (estimated) required for completion of existing project	2,135,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	200,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix G G 6.)

7. Operating and care of locks and dams on Kentucky River, Kentucky.—The maintenance of these works devolves upon the indefinite appropriation of July 5, 1884, for operating and care of canals and other works of navigation; the total expended to June 30, 1901, was $881,392.16; the amount expended during the fiscal year ending June 30, 1902, was $65,107.03. With this sum the locks were operated and the channels maintained in navigable condition.

On June 30, 1902, the system was in good navigable condition, but the works have deteriorated considerably and preparations are being made to extensively repair the dam at Lock No. 1 and the cribs at several of the others.

The commerce, in tons of freight, at the different locks for the last four years has been as follows:

Lock.	Calendar year.			
	1898.	1899.	1900.	1901.
No. 1	74,175	96,651	113,823	122,385
No. 2	67,080	83,809	95,353	108,517
No. 3	55,469	72,370	90,866	103,761
No. 4	52,727	72,983	84,005	92,131
No. 5	56,351	83,866	119,711	147,134
No. 6	46,878	73,300	113,192	137,345
No. 7	47,642	94,379	127,405	135,473
No. 8			8,348	147,062
Average	57,189	82,480	106,336	124,226

(See Appendix G G 7.)

IMPROVEMENT OF FALLS OF THE OHIO RIVER; OF WHITE RIVER, INDIANA; OF WABASH RIVER, INDIANA AND ILLINOIS, AND OF CERTAIN RIVERS IN KENTUCKY.

This district was in the charge of Capt. W. L. Sibert, Corps of Engineers, to December 11, 1901, and in the temporary charge of Maj. E. H. Ruffner, Corps of Engineers, since that date. Division Engineer, Col. Amos Stickney, Corps of Engineers, to July 24, 1901, Lieut. Col. Thos. H. Handbury, Corps of Engineers, from July 24, 1901, to January 15, 1902, and of Col. G. J. Lydecker, Corps of Engineers, since that date.

1. Falls of the Ohio River at Louisville, Ky.—Appropriations for improving the Falls of the Ohio River at Louisville, Ky., have been applied to the widening and straightening of the upper end of the Louisville and Portland Canal; the enlargement of the basin above the new locks; and to the straightening, deepening, and control of water flow of the channel known as the Indiana Chute. Under these separate heads the original condition was as follows:

Before the adoption of the original project in 1883, the approach to the canal and its upper end above the railroad bridge was so narrow as to be a source of constant delay to the large coal fleets which came down the river on ordinary rises. The canal proper, from Ninth to Fourteenth streets, was only 100 feet wide and curved between the two points, so that progress was slow and accidents frequent and unavoidable. The greater part of the dike marking the north line of the approach was submerged when the river reached a stage of 8.4 feet, upper canal gauge; and at 9 feet and above a strong cross current was created by which many vessels were pulled against the structure, and at high water carried over it to the rock ledges. This approach was

1,800 feet long, 400 feet wide at its upper end, and 100 feet wide at the mouth of the canal, opposite Ninth street. Its area was not sufficient for making up or breaking tows before leaving or entering the canal. The main channel of the river, by which commerce passes the falls when the stage of the river is such as to permit navigation over them, is known as Indiana Chute. Originally it was very crooked, with swift currents and whirls, filled with dangerous rocky points projecting from the sides and bottom, and navigable by skilled pilots only when the river was up to or above 11 feet on the upper gauge of the Louisville and Portland Canal.

Prior to January 31, 1890, there was no specific project for the improvement of Indiana Chute. The work was carried on with allotments from appropriations for improving Ohio River, and under projects, having in view the removal of projecting rocks and straightening the channel between the cross dam and railroad bridge, but no definite limits were prescribed within which work was to be done. The work, previous to the adoption of the definite project, resulted in increasing the safe channel between the cross dam and railroad bridge from 60 to 250 feet, and the removal of a large mass of reefs just below the bridge known as Rubels Rocks.

The projects under which work has been, and is now, carried on are as follows: The original, adopted in 1883, and slightly modified in 1885, which provided for the enlargement of the canal from its mouth to a point below the railroad bridge and a large harbor or basin above the mouth; that approved January 31, 1890, after having been considered and submitted by a Board of Engineer officers convened for that purpose, which included work and structures at the head of the canal and in the Indiana Chute, to provide a navigable channel through the latter when the stage of the river is at or above 8 feet upper canal gauge. A revision of the latter project, submitted by a Board of Engineer officers and approved April 8, 1899, modified the area to be excavated and determined definitely the character of the structures to be erected in the enlargement at the head of the canal. That portion of the project pertaining particularly to the enlargement of the easterly end of the canal provides for enlarging the canal on its northerly side from a point 725 feet below the railroad bridge near Fourteenth street, where the canal is abruptly increased from 90 to 210 feet in width. This latter width is gradually increased through a distance of nearly 2,800 feet to 325 feet at the head of the canal proper, at which point the enlargement is expanded into a capacious basin 1,200 feet wide, and practically parallel to the Kentucky shore. Along the western line of this basin a movable dam is provided, which will hold the river at stages of 8 feet and less and serve as a sluice for carrying away mud and deposit at stages greater than 8 feet. The dam on the north line of the basin, connecting one end of the movable dam with the present cross dam at the south abutment of the middle chute, is built of concrete, with its crest at 8 feet upper canal gauge, which provides a basin with ample accommodations for the movement of vessels and tows approaching the canal.

The project of January 31, 1890, as applied to the Indiana Chute, is not materially changed by the revision approved April 8, 1899. The general object is to make the chute safely navigable for descending traffic when the stage of the river is at or above 8 feet upper canal gauge, by providing a good channel 400 feet wide between the cross dam and

railroad bridge. The top of Wave Rock is to be excavated to reference 22, and Willow Point to reference 19. Below Willow Point a stone dike 1,250 feet long, and below Wave Rock a similar structure 2,300 feet long, curving downstream, will fix the navigable channel at a width of about 700 feet. These dikes are also intended to reduce the area of discharge of the chute, so as to maintain the 8-foot depth over Wave Rock and Willow Point as long as that depth exists in the channel at the head.

The original estimate of cost, approved January 31, 1890, was $848,841.37. The revision, approved April 8, 1899, increased this estimate $41,091.58, and in the Annual Report of the Chief of Engineers for 1901 it was estimated that it would require $91,298.21 to complete the work.

Following is a synopsis of expenditures under the allotments and projects referred to above, together with their revision and modifications:

Expended from allotments 1881 to January 31, 1890		$116,049.80
Expended under project 1883 for enlargement of head of canal, to January 31, 1890		347,380.68
Reserved, Office Chief of Engineers		1,874.20
Expended under project for enlarging basin at canal locks		133,000.00
Expended under revised project of January 31, 1890, to June 30, 1897:		
On enlargement at head of canal	$298,856.35	
On Indiana Chute channel	103,602.81	
		402,459.16
Expended under combined appropriations for enlargement at head of canal and Indiana Chute, and under project of January 31, 1890, to March 31, 1899		208,659.75
Expended under combined appropriations for enlargement at head of canal and Indiana Chute, under project of March 31, 1899, to June 30, 1902		304,457.86
Aggregate		1,513,881.45

Of this amount, approximately $600 was expended for maintenance to the Wave Rock and Willow Point dikes during the past fiscal year.

The lower part of the Indiana Chute was completed in October, 1901. Gauge readings indicate 8 feet of water on Wave Rock when there is a similar stage in the canal, and the channel, which was formerly crooked and dangerous, is now comparatively straight and easy to run. This completed all work recommended by boards prior to December, 1901.

The upper end of the canal mouth, opposite Ninth street, has been increased from 100 to 325 feet in width. A statement showing the quantity and character of commerce passing through the canal and over the falls may be seen by reference to the report of operating and care of Louisville and Portland Canal.

The Board of Engineer officers in 1899 recommended that certain features of the proposed improvement of Indiana Chute should not be carried on until the approved features were completed and their effect noted. The approved features having been completed, a Board of Engineer officers was constituted by Special Orders, No. 41, Headquarters, Corps of Engineers, United States Army, Washington, D. C., October 29, 1901, to consider and report upon the additional work necessary to produce an 8-foot channel in the upper part of the chute when there was a similar stage in the canal. The report of this Board contemplates forcing into the Indiana Chute enough water to make a

channel of the required width and depth, the water to be controlled by concrete dikes on either side of the chute, and by submerged dams, if the latter are found necessary.

To secure the volume of water necessary in the chute above the railroad bridge it is proposed to raise the Boulé dam adjoining the north wall of the canal from 8 to 9.5 feet on upper canal gauge, and to increase the discharge into the chute by the removal of that portion of the present fixed cross dam between the Middle and Indiana chutes; but as a dam at this place is necessary to maintain navigation through the canal and in the river above during lower stages, the Board adopted a movable dam, which is to be kept up until an 8-foot stage is reached. A submerged dam is to be built across the bend channel just below Whirlpool Point for the purpose of decreasing the water slope above Wave Rock. The proposed improvements are expected to greatly facilitate and increase the navigation of the falls, it being estimated that for coal alone the availability of the Indiana Chute will be increased 43½ per cent for barge tows and 100 per cent for boat tows. The estimated cost of the proposed work is $466,180, of which $125,600 may be unnecessary should the dam at Whirlpool Point produce a sufficient raise in the surface at and above Wave Rock. This amount is not an increase in the estimate of the former boards for improving the falls, but is the amount necessary to complete the work omitted by the Board of 1890, and which was considered and approved by the Board of 1901 and by the Chief of Engineers.

The details of this proposed additional work will be found in Appendix H H 1, page 1970, of this report.

July 1, 1901, balance unexpended	$34,615.62
Amount appropriated by river and harbor act approved June 13, 1902	41,000.00
	75,615.62
June 30, 1902, amount expended during fiscal year	21,247.07
July 1, 1902, balance unexpended	54,368.55
July 1, 1902, outstanding liabilities	1,111.36
July 1, 1902, balance available	53,257.19

(See Appendix H H 1.)

2. Operating and care of Louisville and Portland Canal.—The present work is the outgrowth of the construction of the canal by a private corporation in 1830, and its transfer to the United States in 1874 by the authority of Congress. The canal is about 2 miles long and 90 feet wide below the enlargement at the head. There are 2 new masonry locks in flight, the chambers of each being 350 feet long and 80 feet wide.

The annual estimates and projects have provided for operation and maintenance in good navigable condition, together with such special work as may from time to time be found necessary to make it sufficient to meet the demands of navigation and commerce.

Expenditures from July 1, 1880, when tolls were abolished and the canal became a direct charge on the Treasury, to June 30, 1902, amounted to $1,674,122.17, not including outstanding liabilities.

The canal is available to commerce at all stages of water less than 12.7 feet, upper gauge, and serves its purpose by permitting free

navigation around the falls of the Ohio River at stages of water when the passage can not be made by the open-river channel.

During the fiscal year ending June 30, 1901, 4,742 boats, barges, and small craft passed through the canal; the tonnage of these amounted to 1,061,643 and they carried 847,710 tons of freight and 16,313 passengers. The annual average for the past twenty-one years of traffic, and commerce for the past sixteen years, passing this place via canal and open river is as follows: Boats, 6,774; tonnage, 1,841,908; average freight carried, 1,966,148 tons.

(See Appendix H H 2.)

3. Wabash River, Indiana and Illinois.—In its original condition this river was badly obstructed by bars, accumulations of snags, rocky reefs, and numerous secondary channels or cut-offs, which lessened the flow of water through the main channel, and navigation was impossible except at high stages of water.

From the commencement of the work in 1872 to March 31, 1881, the expenditures, all of which were for work below Vincennes, amounted to $324,845.44. Since March, 1881, expenditures for each section of the river are given below separately.

(*a*) *Below Vincennes.*—From March, 1881, to June 30, 1902, expenditures for work below Vincennes amounted to $369,808.17, including $25,000 expended for levee work at Grayville, Ill.

Since 1884 the greater part of the appropriations for the section below Vincennes has been applied to the construction of a masonry lock, timber dam with masonry abutment, and timber guide cribs at Grand Rapids. These works were completed in 1894.

Since the operations and funds have been concentrated to complete the structures just mentioned, and work necessarily suspended elsewhere on the river, the improvements at other places have rotted away or been damaged by ice and freshets. High water has cut its way around them, leaving the river as badly obstructed as it was before its improvement was commenced, and with no improvement to its navigation and commerce other than the channels cut through solid rock and the lock at Grand Rapids, which latter will be of little benefit unless the river is improved in such manner as to enable boats to reach that point.

Therefore, considered as an entirety, this section of the river at a normal stage is not available for navigation. The obstructions now existing present no unusual features to indicate that they would be difficult to overcome, and with sufficient funds for regular and continuous operations the river could be easily adapted to the requirements of commerce. The improvements, however, should begin at the mouth of the river and be carried continuously upstream. No work was done on this section of the river during the past year.

The only commercial statistics available are those collected at the lock at Grand Rapids, and given in the report upon operating and care of that work.

There is in existence no approved project with estimate which adequately provides for the systematic improvement of the Wabash River, and as a prerequisite to the preparation of such a project a detailed survey is necessary. The river and harbor act of June 13, 1902, provides for a survey and estimate for the improvement of this section of the river.

July 1, 1901, balance unexpended	$15,346.39
Amount appropriated by river and harbor act approved June 13, 1902	5,000.00
July 1, 1902, balance unexpended	20,346.39
July 1, 1902, outstanding liabilities	25.75
July 1, 1902, balance available	20,320.64

(*b*) *Above Vincennes.*—Since this part of the river became the object of special appropriations the sum of $94,933.65 had been expended to June 30, 1902. Formerly a good channel 3 feet in depth was maintained, but for several years past the appropriations have been too small to permit of other than snagging operations at irregular intervals. The channel at present is available for navigation only at high stages of water. At low water the numerous snags, bars, and secondary channels render navigation, even with boats of lightest draft, extremely hazardous. No regular line of steamboats operates upon this section of the river. The only traffic is carried on during high stages of water, when a few light-draft boats make irregular trips to transport corn, wheat, oats, and similar commodities to the nearest railway for shipment.

Funds under the former estimate are so nearly exhausted that further field work is not proposed for the ensuing fiscal year. Recommendations as to additional appropriations can not be made until the survey and estimate provided for in the river and harbor act of June 13, 1902, for the section below Vincennes have been completed.

July 1, 1901, balance unexpended	$566.35
July 1, 1902, balance unexpended	566.35

(See Appendix H H 3.)

4. Operating and care of lock and dam at Grand Rapids, Wabash River.—This lock and dam were built from funds derived from appropriations for improving Wabash River, Indiana and Illinois. The operating expenses were also paid from that appropriation until March 1, 1897, since which date they have been paid from allotments from the indefinite appropriation for operating and care of canals and other works of navigation, act of July 5, 1884. The annual projects and estimates provide for the lock's operation and such repairs thereto and the appurtenant structures as may be necessary to maintain them in good condition. From March 1, 1897, to June 30, 1902, the expenditures amounted to $21,372.05.

A synopsis of traffic through the lock during the fiscal year 1902 is as follows: Boats, etc., 278; tonnage, 6,736; freight, 1,278½ tons.

(See Appendix H H 4.)

5. White River, Indiana.—Originally this river was, throughout the entire reach embraced within the project, badly obstructed by rock reefs, shoals, remains of old structures, and a very great number of snags. It could be navigated only during high stages of water.

The original project is based upon report of examination of the White River and its forks in Indiana, submitted December 31, 1878, and the first provision for improvement was made in the river and harbor act of March 3, 1879. The object was to provide a channel as far as might be practicable without constructing locks and dams, at an estimated cost of $150,000. The project has not been amended or revised. Funds under the former estimate are practically exhausted. The river and harbor act of August 18, 1894, provided for a resurvey

of the river and certain portions of the forks. Full report of this survey and estimate of cost under alternative plans for improvement will be found on pages 2483 to 2496, Annual Report of the Chief of Engineers for 1896. The total expenditures to June 30, 1902, were $119,296.18. The lower 13 miles of the river are navigable for boats drawing 3 feet; above this to the junction of the two forks, and about 5 miles up East Fork, boats drawing 18 inches can navigate about one month in the year.

July 1, 1901, balance unexpended	$703.82
July 1, 1902, balance unexpended	703.82

(See Appendix H H 5.)

6. Green River above the mouth of Big Barren River, Kentucky.—Originally this part of Green River was much obstructed by snags, bowlders, and overhanging trees. Dam No. 4, Green River, afforded slack water for about 18 miles.

The original project is that submitted under date of August 11, 1891 (printed in Annual Report of the Chief of Engineers for 1891, p. 2481), and provided for slack-water navigation from the upper limits of Pool No. 4 to Mammoth Cave, by the construction of two locks and dams, at an estimated cost of $361,346.40 for both. One of the locks and dams has been completed and opened to navigation, thus leaving one more lock and dam to be constructed to complete the project. The amount expended on the work up to the close of the fiscal year ending June 30, 1902, was $179,653.59. The result, as stated above, is the completion of Lock and Dam No. 5, and the extension of slack-water navigation through a part of the rich mineral district bordering on the river, and which heretofore had no conveniently accessible means of transportation.

The river and harbor act approved June 13, 1902, provides funds to the amount of $180,000 for the construction of Lock No. 6.

Traffic and commerce statistics are given in the report for operating and care of locks and dams on Green and Barren rivers, Kentucky.

July 1, 1901, balance unexpended	$4,393.22	
Amount appropriated by river and harbor act approved June 13, 1902	180,000.00	
		184,393.22
June 30, 1902, amount expended during fiscal year		3,373.61
July 1, 1902, balance unexpended		181,019.61
July 1, 1902, outstanding liabilities		94.74
July 1, 1902, balance available		180,924.87

(See Appendix H H 6.)

7. Operating and care of locks and dams on Green and Barren rivers, Kentucky.—The United States acquired possession of the five locks and dams on Green and Barren rivers on December 11, 1888, by purchase of the unexpired lease of the Green and Barren River Navigation Company, the legislature of the State of Kentucky having ceded them, with land and appurtenances pertaining thereto, to the United States upon condition that the latter should extinguish the claim of the navigation company to take tolls and to exercise control over the rivers.

At the time of the transfer the river wall of Lock No. 3, Green River, had fallen into the river; the lower end of the land wall of Lock No. 1, Barren River, was badly cracked and liable to fall at any time, and both

walls of Lock No. 2, Green River, were in a dangerous condition. The channel of the river was much obstructed by snags and slides.

Since the United States acquired control of the locks and dams navigation throughout the entire system has been restored by either extensive repairs or new work. The expenditures for repairs, operations, and maintenance to June 30, 1902, aggregated $1,134,773.23, including $135,000 purchase price.

Following is a synopsis of traffic through the locks during the fiscal years 1901 and 1902:

	Boats.				Freight.	
	1901.	1902.	1901.	1902.	1901.	1902.
Green River:	*No.*	*No.*	*Tonnage.*	*Tonnage.*	*Tons.*	*Tons.*
Lock No. 1	3,856	2,772	558,630	515,475	452,522	385,548
Lock No. 2	3,102	2,366	483,112	450,094	285,744	242,722
Lock No. 3	2,410	2,053	414,417	447,777	183,512	158,037
Lock No. 4	2,580	2,157	370,845	425,198	117,054	110,468
Lock No. 5	1,005	1,014	124,916	169,784	57,058	47,940
Barren River:						
Lock No. 1	1,612	1,476	195,047	201,099	46,445	30,616

(See Appendix II H 7.)

8. Rough River, Kentucky.—Originally this river was very much obstructed by snags, sunken logs, and bowlders in the bed, and by overhanging trees on the banks. Backwater from Rumsey Dam No. 2, on Green River, affected the lower 8 miles of the river, but above that distance the stream was very shallow at low water.

The project for the improvement, adopted in 1890, provided for the clearing of the river of obstructions, and for the location and construction of a lock and dam, so as to carry slack water to Hartford, Ky., for boats not exceeding 123 feet in length, 27 feet in width, and 4 feet draft.

This lock and dam were completed in 1896. Expenditures to June 30, 1902, amounted to $102,304.81.

Commercial statistics for the river are given under report for operating and care of lock and dam on Rough River, Kentucky.

July 1, 1901, balance unexpended	$3,195.19
July 1, 1902, balance unexpended	3,195.19
July 1, 1902, outstanding liabilities	17.27
July 1, 1902, balance available	3,177.92

(See Appendix H H 8.)

9. Operating and care of lock and dam on Rough River, Kentucky.—This lock and dam were built from funds provided in appropriations for improving Rough River, Kentucky, and opened to navigation December 12, 1896. The expenses of their operation and care since July 1, 1897, have been paid from allotments from the indefinite appropriation for operating and care of canals and other works of navigation, act of July 5, 1884. The total of these expenditures to June 30, 1902, was $5,058.98.

The lock and dam afford slack-water navigation to Hartford, Ky.

Traffic through the lock during the past fiscal year included 505 boats of various kinds, with an aggregate tonnage of 20,110, carrying 21,703 tons of freight.

(See Appendix H H 9.)

LAKE RIVERS AND HARBORS.

IMPROVEMENT OF RIVERS AND HARBORS ON LAKE SUPERIOR.

This district was in the charge of Capt. D. D. Gaillard, Corps of Engineers. Division Engineer, Col. S. M. Mansfield, Corps of Engineers, to July 24, 1901, and Lieut. Col. O. H. Ernst, Corps of Engineers, since that date.

1. Harbor at Grand Marais, Minn.—This harbor is an elliptical bay, whose major axis is about one-half mile and whose minor axis is about one-fourth of a mile in length. It has an opening on the south side which was originally about 1,000 feet in width. Before improvement there was a maximum depth of 14 feet over a very limited area, the general average depth being only 8 or 9 feet. It is the only harbor of refuge on the north shore between Agate Bay and the international boundary line.

The approved project of April, 1879, is to build two breakwater piers, each 350 feet long, from the east and west points of the bay, or one pier 700 feet long from the east point, and dredge an anchorage area of about 26 acres to a depth of at least 16 feet, all at an estimated cost of $139,669.40, but for reasons explained in the report of the local officer (Annual Report of the Chief of Engineers for 1898, p. 2217) this was increased to $163,954.63.

Two breakwaters, each 350 feet long, have been constructed from the east and west points of the bay, the work being completed on August 13, 1901.

The amount expended on the project up to the close of the fiscal year ending June 30, 1902, not including outstanding liabilities, was $163,089.18, of which about $2,000 was for maintenance. The work done has resulted in a more protected harbor, and a 16-foot anchorage area of about 26 acres.

The minimum mean low-water depth, June 30, 1902, over the shoalest part of the locality under improvement, was 16 feet.

The usual variations of water level extend from about 0 to +1 foot above low-water datum.

The commerce of the port has increased from 25 entrances and clearances, made by 4 tugs and 5 schooners, with 60 tons of cargo, valued at $6,000, in 1878, to 418 clearances and entrances, nearly all steamers, with 24,118 tons of cargo, valued at $249,144, in 1901.

The value of the commerce of the harbor from 1878 to 1901. both inclusive, is estimated at $2,726,864.

July 1, 1901, balance unexpended	$20,937.08
Amount appropriated by river and harbor act approved June 13, 1902	2,000.00
	22,937.08
June 30, 1902, amount expended during fiscal year	20,676.26
July 1, 1902, balance unexpended	2,260.82

(See Appendix I I 1.)

2. Harbor at Agate Bay, Minnesota.—This important harbor, situated on the north shore of Lake Superior, 27 miles northeast of Duluth, Minn., is a shipping port for iron ore and a harbor of refuge.

Before improvement there was ample depth for navigation, but the harbor was exposed to storms from the southwest, and to reverse swells from severe northeast storms.

The approved project of January 4, 1887, was to construct two breakwater piers on a line toward each other from the eastern and western points of the bay to be 1,000 and 900 feet long, respectively, leaving an opening of 1,340 feet between their extremities and inclosing an area of 109 acres.

By letter of the Chief of Engineers, March 23, 1899, the total ultimate length of the easterly breakwater was increased by 50 feet.

The original estimate of cost was $213,000, which was increased to $244,208 in annual report of 1887 on account of higher prices.

The amount expended on the approved project up to the close of the fiscal year ending June 30, 1902, not including outstanding liabilities, was $244,022.99, of which about $10,000 was applied to the maintenance of the improvement.

The project was completed on November 1, 1901, and fulfills very effectually the purpose for which it was designed.

The depth at the entrance is over 50 feet, and vessels drawing 20 feet can reach the ore piers in safety.

The usual variation of water level extends from about 0 to about +1 foot above low-water datum.

The vessel freight of this harbor has increased from 236,000 tons of 2,240 pounds, valued at $524,800, in 1885, to 5,816,583 tons of 2,000 pounds, valued at $13,602,018, in 1901.

The total valuation of the commerce of this port for seventeen years, 1885 to 1901, inclusive, is estimated at $63,356,018.

July 1, 1901, balance unexpended	$29,194.10
Amount appropriated by river and harbor act approved June 13, 1902	2,000.00
	31,194.10
June 30, 1902, amount expended during fiscal year	29,009.09
July 1, 1902, balance unexpended	2,185.01

(See Appendix I I 2.)

3. Harbor at Duluth, Minn., and Superior, Wis.—Previous to the annual report of 1897 this harbor was reported on under the separate heads of Duluth, Minn., and Superior, Wis., respectively.

The act of June 3, 1896, unified these harbors under the above title, and provided for continuous contracts for its improvement to the amount of $3,080,553.

This harbor consists of the Duluth Canal, the Wisconsin Entrance, Superior Bay, Allouez Bay, St. Louis Bay, and St. Louis River to the limits of the cities of Duluth and Superior, about 20 miles from the original natural entry, which before improvement was obstructed by shifting bars, with but 9 feet of water over them. The bays were broad expanses of shallow water, averaging only 8 or 9 feet, except along the channel through them, where the depth was greater but variable.

The project adopted by the act of March 3, 1881, previous to the present one, was for 16-foot navigation. This was practically completed July 1, 1897, and resulted in giving a good 16-foot navigation through the natural or Wisconsin Entry, through the artificial Duluth Canal; over the Duluth Basin of 104 acres; along and parallel to the dock lines of Duluth and Superior, in Superior and St. Louis bays, and up the St. Louis River to New Duluth, near the head of navigation of the river, with well-defined channels from 85 to 300 feet in width.

The present project, authorized by the act of June 3, 1896, and by the modifications of August 14, 1896, and May 9, 1901, provides for the widening and deepening to a navigable depth of 20 feet of the existing channels, for new channels in Allouez Bay and St. Louis River, for extensive turning and anchorage basins of a navigable depth of 20 feet at the junctions of two or more channels, for widening the Duluth Canal, and for rebuilding the piers at the Duluth Canal and Wisconsin Entry and finishing them off with concrete superstructures built of monolithic blocks.

The estimated cost of the work was $3,130,553, but this referred only to the deepening of the channels and basins by dredging. This will be done at much less than the estimated cost, permitting the purchase of lands to the extent of $99,861.19, the rebuilding of the Duluth Canal piers at a cost of over $650,000, and leaving a probable balance of about $275,000 toward the rebuilding of the piers at the Wisconsin Entry.

The amount expended on the existing project to the close of the fiscal year ending June 30, 1902, exclusive of outstanding liabilities, was $2,501,694.90, of which $200,000 was expended for maintenance.

The work done up to the close of the past fiscal year has been as follows:

The two contracts for dredging the channels and basins have been in operation for six seasons, and up to June 30, 1902, 19,521,475 cubic yards of material has been removed.

All the land necessary for the widening of the Duluth Canal has been acquired by deed of gift, purchase, or condemnation, at a cost of $53,919.05.

The land needed for improvement at the Wisconsin Entry, the mouth of the Nemadji River, and on a marshy island in the St. Louis River was obtained by condemnation proceedings at a cost of $42,795.94.

A small parcel of land at the end of Grassy Point, and certain lands in Spirit Lake were purchased at a cost of $3,146.20.

Both piers of the Duluth Canal have been completed and equipped with lamp posts.

The lake, harbor, and park walls inclosing the United States lands on the north side of the Duluth Canal have been completed, and similar work is now in progress on the south side of the canal.

The filling of the large submerged areas on either side of the canal, involving the deposit of about 50,000 cubic yards of material, has been almost completed.

It is believed that dredging operations will be successfully completed about the middle of the season of 1903, giving more than 16 miles of dredged channels from 120 to 600 feet in width, and basins of an aggregate area of about 360 acres, all of a depth of 20 feet or over, which must be maintained thereafter by dredging as needed.

This work can best be done by plant owned and operated by the United States, the cost of which is estimated at $150,000. With this plant provided, the officer in charge estimates that the channels and basins can be maintained for an annual sum equivalent to about 3 mills per ton for the vessel freight of the harbor each year.

The piers at the Wisconsin Entry were placed about thirty-two years ago in water of an average depth of 8 to 10 feet, the object then being to secure a depth of 12 feet in the channel. With the growth of commerce the channel depth has been increased to 24 feet, and the crib bottoms are now many feet above the bottom of the

channel. Owing to this and other causes considerable displacement has resulted, and the present piers should be replaced by new ones. The estimated cost of this work is $925,000. The estimated balance from the appropriations authorized by the act of June 3, 1896, is $275,000.

The act of Congress approved June 13, 1902, appropriates $200,000 for the improvement of Duluth-Superior Harbor, and provides that not less than $100,000 of this amount shall be expended in prosecuting the work of rebuilding the piers at the Wisconsin Entry of this harbor.

The least depth at low-water datum at any part of the area under improvement is 20 feet.

The usual variation of water level extends from about 0 to +1 foot above low-water datum.

The improvements made are in excellent condition, and the expenditure has been amply justified by the immense commerce which it has readily accommodated.

The lake commerce of this port, Duluth-Superior, during the last season of navigation amounted to 12,973,373 tons (of 2,000 pounds), valued at $161,305,819, and from the beginning of improvements by the United States in 1867 to the close of the calendar year 1901 the vessel freight entering and departing has amounted to 103,458,373 tons (of 2,000 pounds) valued at $1,614,657,819.

The tonnage for 1901 is much the largest in the history of the port.

It is believed that the tonnage of Duluth-Superior Harbor is now exceeded by that of but three ports in the United States—New York, Philadelphia, and Boston.

July 1, 1901, balance unexpended	$665,859.74
Amount appropriated by river and harbor act approved June 13, 1902.	200,000.00
Amount appropriated by sundry civil act approved June 28, 1902	459,727.50
	1,325,587.24
June 30, 1902, amount expended during fiscal year	496,729.14
July 1, 1902, balance unexpended	828,858.10
July 1, 1902, outstanding liabilities	141,500.00
July 1, 1902, balance available	687,358.10
July 1, 1902, amount covered by uncompleted contracts	185,000.00

(See Appendix I I 3.)

4. Harbor at Portwing, Wis.—The harbor of Portwing, formed by the mouth of Flag River, is situated on the south shore of Lake Superior, about 33 miles from the head of the lake.

The harbor has been improved by private parties to some extent, but this improvement is of a temporary character.

Before improvement the depth was small and variable.

In accordance with the provisions of the act of Congress approved March 3, 1899, a report upon a survey of this harbor and a project for its improvement were submitted on November 20, 1899.

This project provided for the construction of two parallel piers of piling, filled in with slabs and topped with large rock. These piers were to be located 200 feet apart, and to be 800 feet and 825 feet long, respectively. A channel 150 feet wide and 15 feet deep was to be dredged between the piers and for 500 feet along the slough. The estimated cost of the improvement was $44,992.

By act of Congress approved June 13, 1902, this project was

adopted, and the sum of $25,000 was appropriated, provided the United States should, before the commencement of operations, be given clear title, without cost, to all lands needed for the improvement.

This provision has not yet been complied with.

The private dredging done in April, 1902, gave a narrow channel 16 feet in depth, which can not be regarded as permanent.

The usual variation of water level extends from about 0 to +1 foot above low-water datum.

During the calendar year 1901 there were 64 arrivals and departures at this harbor, with vessel freight of 31,427 tons (of 2,000 pounds) and a valuation of $305,000. In addition, about 400 boats, including tugs and passenger steamers, entered this harbor, but no record was kept of them.

Amount appropriated by river and harbor act approved June 13, 1902... $25,000.00
July 1, 1902, balance unexpended 25,000.00

(See Appendix I I 4.)

5. Harbor at Ashland, Wis.—Ashland Harbor is located at the head of Chequamegon Bay, and originally had no protection from the waves which rolled into the bay, nor from waves generated within the bay itself by storms.

The original project, approved December 7, 1888, and modified February 9, 1889, was for the construction of a pile, slab, and rock breakwater 8,000 feet long and for dredging a channel in front of the wharves of the city. The act of March 3, 1899, added to this project by authorizing an extension of the breakwater to the shore, thus requiring the ultimate construction of 10,200 feet of breakwater. The emergency river and harbor act of June 6, 1900, provided for building a shore spur 4,700 feet in length from a point 2,600 feet east of the prolongation of the present breakwater and parallel thereto. This again changed the project, adding greatly to the total length of breakwater to be constructed and largely to the total expense.

Under this project and its two modifications there has been constructed 7,454 feet of breakwater on the original line, and 842 feet on the line fixed by the act of June 6, 1900.

The total amount expended on this project and its modifications up to the close of the fiscal year ending June 30, 1902, not including outstanding liabilities, is $273,670.63, of which amount $81,444.04 has been applied to the maintenance of the improvement.

The work done gives a protected area of about 1,600 acres, and affords safe anchorage and dockage for a distance of 3 miles along the city front.

The westerly half of the 20-foot dredged channel parallel to the dock line has shoaled in places to a depth of about 16 feet. The easterly half has shoaled but little.

The pile, slab, and rock breakwater on the original line is in very poor condition and will require large expenditures for maintenance.

The usual variations of level of the water surface extends from about 0 to +1 foot above low-water datum.

The commerce of this port consists principally of iron ore and lumber exported, and coal, mineral oil, and general merchandise imported. The commerce has increased during the fifteen years the harbor has been under improvement by the United States from 892 arrivals and clearances, with cargo tonnage of 1,400,000 tons (of 2,000 pounds), in

1887, to 2,352 arrivals and clearances, with cargo tonnage of 4,082,131 tons (of 2,000 pounds), valued at $16,957,639 in 1901, the total commerce from 1887 to 1901, inclusive, being estimated at 42,993,112 tons (of 2,000 pounds), valued at $386,957,639.

July 1, 1901, balance unexpended	$948.55
Amount appropriated by river and harbor act approved June 13, 1902	40,000.00
	40,948.55
June 30, 1902, amount expended during fiscal year	119.18
July 1, 1902, balance unexpended	40,829.37

(See Appendix I I 5.)

6. Harbor at Ontonagon, Mich.—The entrance to Ontonagon River, which forms the harbor, had but 7 feet depth in 1867, at which time the project for securing 12 feet depth by building parallel piers on either side of the mouth, extending to the 18-foot curve of depth in Lake Superior, and dredging a channel between the piers, was adopted. The west pier was built to a length of 2,675 feet and the east pier to a length of 2,315 feet. This brought the outer end of the west pier very nearly to the 18-foot curve of depth, as proposed.

As far as new work is concerned the project has been completed since 1889, and further expenditure will be needed only for keeping a 12-foot channel open by dredging and for the repairs to the piers.

The amount expended on this improvement up to the close of the fiscal year ending June 30, 1902, not including outstanding liabilities, is $344,807.73, of which sum $60,000 has been spent for maintenance of the improvement.

There is still a practicable 12-foot channel between the piers and out into the lake, but this is liable to be impaired each spring by sediment brought down by the high water of the Ontonagon River. The superstructure of the piers is becoming decayed.

The usual variation of water level extends from 0 to + 1 foot above low-water datum.

The great fire in 1896 destroyed the principal commercial industry, the plant of the Diamond Match Company, and this company has not rebuilt.

The town itself is recovering steadily from the effects of this fire, which almost obliterated it, and as it has a fine agricultural region tributary to it, the new growth has every appearance of permanency.

In 1867 there were 449 arrivals and departures, with 5,000 tons of cargo, and in 1901 there were 382 arrivals and departures, with 4,284 tons (of 2,000 pounds) of cargo, valued at $749,110.

The commerce of this port since the commencement of operations by the United States is estimated at 2,705,129 tons (of 2,000 pounds), valued at $70,902,345.

July 1, 1901, balance unexpended	$466.69
Amount appropriated by river and harbor act approved June 13, 1902	5,000.00
	5,466.69
June 30, 1902, amount expended during fiscal year	146.42
July 1, 1902, balance unexpended	5,320.27

(See Appendix I I 6.)

7. Waterway across Keweenaw Point, from Keweenaw Bay to Lake Superior, Michigan.—This work was formerly reported on as the Portage Lake and Lake Superior canals, across Keweenaw Point, Michigan.

In accordance with the provisions of the river and harbor act of September 19, 1890, the United States purchased and assumed the charge and care of these canals on August 3, 1891.

At the time of the purchase by the United States there was a very poor 13-foot navigation; the channel was narrow and crooked, with many sharp bends; it was poorly marked and lighted; the entrance piers were in a very bad condition, the revetments were decayed or entirely gone, and there was a tax on the commerce through the canals in the shape of a tonnage charge.

The original project, adopted January 24, 1887, was—

1. For a 16-foot channel of 70 feet bottom width from bay to lake.
2. A renewal of the canal revetments.
3. A reconstruction of the piers at the Lake Superior entrance and their extension to 30 feet depth of water.
4. The extension of the pier at the Keweenaw entrance to a 20-foot depth of water.
5. At the proper time to increase the channel depth to 20 feet, with a corresponding width, which should not be less than 120 feet.

The sum expended in the purchase of the canals, lands, etc., and on items 1 and 2 of the original project was $850,000.

The act of June 3, 1896, authorized continuing contracts to complete the above to the amount of $1,065,000.

By modification, approved March 15, 1898, the width and depth were to be increased to 120 feet and 20 feet, respectively, as originally contemplated.

The total amount expended on the original project and its modification up to the close of the fiscal year ending June 30, 1902, not including outstanding liabilities, was $1,243,996.56, of which about $10,000 was expended for maintenance.

The entire project has been completed, with the exception of some dredging, which will be completed by the end of the present season.

The channel has a least depth at low-water datum of 19 feet, except at one locality in Portage Lake, where the depth is but 18 feet. As the usual stage of Lake Superior during the period of navigation is about a foot above low-water datum, the actual depth is not less than 19 feet. By the close of the present season the shoals will all have been removed, and a least depth of 20 feet obtained, as contemplated in the project.

The usual variation of water level extends from about 0 to +1 foot above low-water datum.

During the navigation season of 1901 the commerce through this waterway amounted to 2,114,385 tons (of 2,000 pounds) of freight, valued at $57,876,480, and 36,054 passengers. The increase in freight tonnage over that of the preceding year amounted to 13 per cent.

From the commencement of operations for improvement by the United States, in 1891, to the close of the calendar year 1901, it is estimated that the total vessel freight entering and departing aggregated 11,402,597 tons (of 2,000 pounds), valued at $382,963,900.

During the fiscal year ending June 30, 1902, $53,000 was expended in dredging, $77,000 in pier work, and $92,149.26 for revetment work, including contingencies, etc.

July 1, 1901, balance unexpended	$263,152.70
Amount appropriated by sundry civil act approved June 28, 1902	10,000.00
	273,152.70
June 30, 1902, amount expended during fiscal year	222,149.26
July 1, 1902, balance unexpended	51,003.44
July 1, 1902, outstanding liabilities	3,252.45
July 1, 1902, balance available	47,750.99
July 1, 1902, amount covered by uncompleted contracts	43,689.45

(See Appendix I I 7.)

8. Operating and care of waterway across Keweenaw Point from Keweenaw Bay to Lake Superior, Michigan.—During the fiscal year ending June 30, 1902, $8,500 from the permanent-indefinite appropriation of July 5, 1884, was expended in maintaining by dredging a practicable 20-foot stage of water, in superintendence and general operation of the canals, and in guarding against encroachments on the legally established harbor lines; and an allotment of $9,000 from the same source for the same purpose has been made for the fiscal year ending June 30, 1903.

(For further details see "Waterway across Keweenaw Point from Keweenaw Bay to Lake Superior, Michigan.")

(See Appendix I I 7.)

9. Harbor at Marquette, Mich.—This harbor, which had a natural depth of 18 feet or more, afforded no protection to vessels from easterly or northeasterly storms, and projects were approved in 1867 and 1888 for the construction of a breakwater composed of cribs filled with rock and projecting from the shore into the bay a distance of 3,000 feet. This breakwater was finished in 1894, practically as projected, but since its commencement extensive repairs have been made to the superstructure.

The amount expended up to the commencement of operations upon the new project was $469,732.44.

A project for a concrete superstructure was approved February 27, 1890. Its estimated cost was $232,936.71.

Work on this concrete superstructure was begun in the spring of 1895, and 1,500 linear feet has been completed.

Owing to lack of funds no construction work was in progress during the fiscal year ending June 30, 1902.

The amount expended on the new project up to the close of the fiscal year ending June 30, 1902, not including outstanding liabilities, was $88,727.61, of which $2,500 was spent for maintenance.

The work done has resulted in the protection of the ore, coal, lumber, and commercial docks from storms, and has shown the efficiency of the concrete breakwater.

The area sheltered by the breakwater varies in depth from 36 feet, near the outer end of the breakwater, to nothing near the shore.

The usual variation of water level extends from about 0 to +1 foot above low-water datum.

During the fiscal year ending June 30, 1872, there were 780 arrivals and clearances of vessels, with a registered tonnage of 370,000 tons.

In 1901 there were 1,510 arrivals and departures, with a registered tonnage of 2,355,117 tons.

The vessel freight arriving and departing in 1901 aggregated 2,889,501 tons (of 2,000 pounds), valued at $7,921,436.

The total vessel freight since the commencement of improvement by the United States in 1867 is estimated at 22,380,067 tons (of 2,000 pounds), valued at $113,138,417.

July 1, 1901, balance unexpended	$538.22
Amount appropriated by river and harbor act approved June 13, 1902	26,000.00
	26,538.22
June 30, 1902, amount expended during fiscal year	439.58
July 1, 1902, balance unexpended	26,098.64
Amount (estimated) required for completion of existing project	80,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	80,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix I I 8.)

10. Harbor of refuge, Marquette Bay, Michigan.—Marquette Bay is a small bay within the city limits of Marquette, north of Marquette proper, and distant 1½ miles therefrom.

Before improvement the locality was fully exposed to storms from the east and northeast, and comparatively little shipping was done.

A resolution of Congress approved March 20, 1896, directed the Secretary of War to make a survey and submit an estimate for a breakwater in this bay. The results of this survey, with estimates amounting to $20,000 for breakwater 500 feet long and $50,000 for construction of one 1,000 feet long, are published in House Doc. No. 318, Fifty-fourth Congress, first session.

The project adopted by the act of June 3, 1896, is to build a breakwater 1,000 feet in length off Presque Isle Point.

This breakwater was completed to its full length in July, 1900. A recent inspection by the officer in charge shows the work to be in excellent condition.

The total amount expended on the project up to the close of the fiscal year ending June 30, 1902, not including outstanding liabilities, was $49,530.58, of which $2,000 was expended for maintenance.

The work done has enabled vessels to lie in safety at the ore pier and other docks in the vicinity, and shipping has increased greatly.

This harbor is largely used for commercial purposes, but to little or no extent as a harbor of refuge.

Vessels drawing 18 feet or less can reach the ore pier at ordinary stages of the lake.

The usual variation of water level extends from 0 to +1 foot above low-water datum.

Arrivals and clearances in 1896 were 414, with freight tonnage of 347,781 tons (of 2,000 pounds). In 1901 there were 1,138 arrivals and clearances, with freight tonnage of 1,787,012 tons (of 2,000 pounds), valued at $4,153,845.

The principal article of shipment is iron ore.

The total vessel freight arrived and departed since the commencement of operations by the United States in 1897 is estimated at 7,091,730 tons (of 2,000 pounds), valued at $17,415,640.

July 1, 1901, balance unexpended	$837.09
June 30, 1902, amount expended during fiscal year	367.67
July 1, 1902, balance unexpended	469.42

(See Appendix I I 9.)

11. Harbor of refuge at Grand Marais, Mich.—Originally the entrance to this harbor was obstructed by a bar having but 9 feet depth of water upon it. The project for its improvement, adopted August 5, 1881, and modified December 21, 1894, has for its object a deep and safe channel into the harbor, making it a harbor of refuge. This object is to be attained by building parallel piers 500 feet apart projecting into the lake to a depth of 22 feet, and dredging out an 18-foot channel between them, connecting the deep water of the lake with that of the harbor, and by closing up the natural entrance, 5,700 feet in width, by a solid pile dike, driven with a slope toward the waves and strongly braced. The proposed length of each pier was 1,800 feet. The estimated cost of the entire project was $484,000. The west pier has now reached a length of 1,656 feet, the east pier 1,353 feet, and the pile dike is completed. The outer 200 feet of the east pier has not yet been provided with a superstructure.

The amount expended on the project up to the close of the fiscal year ending June 30, 1902, not including outstanding liabilities, was $330,598.32, of which $25,000 was expended for maintenance.

In April, 1902, there was a least depth in the entrance between the piers of about 14 feet.

The usual variation of water level extends from about 0 to about +1 foot above low-water datum.

No construction work has been in progress during the past fiscal year.

The present depth is not sufficient to afford refuge for the larger class of vessels.

The marine commerce of this harbor has increased from 1,910 tons in 1887 to 113,397 tons (of 2,000 pounds), valued at $1,477,998, in 1901.

The total vessel freight of the port, both entering and departing, since the commencement of operations of improvement by the United States in 1880, is estimated at 867,174 tons (of 2,000 pounds), valued at $10,212,929.

July 1, 1901, balance unexpended	$6.78
Amount appropriated by river and harbor act approved June 13, 1902	70,000.00
	70,006.78
June 30, 1902, amount expended during fiscal year	6.78
July 1, 1902, balance unexpended	70,000.00

(See Appendix I I 10.)

12. Removing sunken vessels or craft obstructing or endangering navigation.—The wreck of the steam tug *E. P. Ferry* was removed from Duluth Harbor at a cost of $170.

(See Appendix I I 11.)

IMPROVEMENT OF RIVERS AND HARBORS ON WESTERN SHORE OF LAKE MICHIGAN.

This district was in the charge of Maj. J. G. Warren, Corps of Engineers. Division Engineer, Col. S. M. Mansfield, Corps of Engineers, to July 24, 1901, and Lieut. Col. O. H. Ernst, Corps of Engineers, since that date.

1. Menominee Harbor and River, Michigan and Wisconsin.—Prior to act of June 13, 1902, the harbor and river constituted two works; by this act they were consolidated.

(*a*) *Harbor.*—Original depth of channel, about 5 feet; width, 200 feet. Project adopted in 1874 to obtain a depth of 15 feet; modified in 1899 for increasing the depth to 20 feet. Amount expended on original and modified projects, $234,344.77.

(*b*) *River.*—Original navigable depth, 5 feet. Project adopted in 1890 to obtain a depth of 17 feet. Expended on original and modified projects, $114,414.15.

(*c*) *Harbor and river.*—The existing project adopted by act of Congress approved June 13, 1902, provides for increasing the depth to 20 feet. Estimated cost, $60,000. There were no operations or expenditures on this project up to June 30, 1902.

The channel has a depth of 20 feet, from the 20-foot contour in Green Bay, for a distance of 3,145 feet; above that point, 17 feet.

Maximum draft that could be carried June 30, 1902, was 19 feet in the first section of the channel and 16 feet in the remainder. Usual mean annual variation in level of water surface is 0.99 foot.

The commercial statistics show the value, changes, and character of commerce benefited.

More extended information and maps are printed in Annual Report of the Chief of Engineers for 1893, page 2706, and 1896, pages 2460 and 2463. For reports on examinations and surveys, see House Docs. No. 86, Fifty-fourth Congress, second session (annual report for 1897, p. 2751), and No. 419, Fifty-sixth Congress, first session (annual report for 1900, p. 3739).

Commercial statistics.—Arrivals of vessels, 737. Exports and imports, 775,786 tons.

July 1, 1901, balance unexpended:		
Menominee Harbor	$1,880.68	
Menominee River	85.88	
		$1,966.56
Amount appropriated by river and harbor act approved June 13, 1902		50,350.00
		52,316.56
June 30, 1902, amount expended during fiscal year		1,513.45
July 1, 1902, balance unexpended		50,803.11

(See Appendix J J 1.)

2. Oconto Harbor, Wisconsin.—The original depth at the mouth of the river, about 3 feet, was increased by private enterprise to 4 feet before work was begun by the United States.

With funds appropriated by Congress in 1881 and 1882, operations were begun in 1882 for the formation of a channel 100 feet wide and 9 feet deep, extending from Green Bay up the river for a distance of about 2 miles. As modified in 1897, the improvement of 3,800 feet of the upper end of the channel upon which no work had been done was abandoned. The latter is considered to be the existing project; estimated cost, $115,610. The amount expended to June 30, 1902, was $92,091.05.

The 9-foot channel was completed to the required width in 1899, except for a distance of about 600 feet.

The maximum draft that could be carried June 30, 1902, was about 7.5 feet.

Mean annual variation in level of water surface is 0.99 foot.

The volume of commerce benefited is very small, and it is of a purely local character.

For more extended information and maps see Annual Report of the Chief of Engineers for 1888, page 1840, and for 1896, pages 2465 and 2561 to 2564.

For reports on examinations and surveys see House Docs. No. 223, Fifty-fourth Congress, first session (annual report for 1896, p. 2560), and No. 50, Fifty-sixth Congress, first session (annual report for 1900, p. 3745).

July 1, 1901, balance unexpended	$949.95
Amount appropriated by river and harbor act approved June 13, 1902	3,000.00
	3,949.95
June 30, 1902, amount expended during fiscal year	41.00
July 1, 1902, balance unexpended	3,908.95

(See Appendix J J 2.)

3. Green Bay Harbor, Wisconsin.—This work consists of two improved channels: First, from the mouth of Fox River northerly to the 17-foot contour in Green Bay; second, Fox River below Depere, to the southerly limits of the city of Green Bay. The intervening pool in Fox River connecting these channels had a natural depth of from 25 feet to 40 feet and required no improvement. The outer channel was originally circuitous and narrow, with an available depth of 11 feet. The original navigable depth of the inner channel was also 11 feet.

The original projects for the improvement of these channels were adopted in 1866 and 1892, respectively, to obtain a depth in each of 13 feet; subsequent modifications provided for increasing their depths to 17 feet. The width of the outer channel varies from 200 feet to 500 feet; width of inner channel, 150 feet. These channels were completed by the expenditure of $405,945.18.

The existing project, adopted by Congress by act approved June 13, 1902, provides for increasing the depth of the outer channel to 20 feet, at an estimated cost of $105,600. There were no operations or expenditures on this project up to June 30, 1902.

The maximum draft that could be carried June 30, 1902, was 16 feet. The mean annual variation in level of water surface is 0.99 foot.

The commercial statistics indicate that the volume of commerce is large and that it is of a general character.

For more extended information and maps see Annual Report of the Chief of Engineers for 1894, pages 2053, 2054, and for 1896, page 2469.

For reports on examinations and surveys see House Ex. Doc. No. 22, Fifty-second Congress, second session, and House Doc. No. 232, Fifty-sixth Congress, first session.

Commercial statistics for 1901.—Arrivals of vessels, 1,442; exports and imports, 1,159,926 tons.

July 1, 1901, balance unexpended	$6,540.81
Amount appropriated by river and harbor act approved June 13, 1902	105,600.00
	112,140.81
June 30, 1902, amount expended during fiscal year	6,283.49
July 1, 1902, balance unexpended	105,857.32

(See Appendix J J 3.)

4. Sturgeon Bay and Lake Michigan Ship Canal, and harbor of refuge connected therewith.—Prior to act of June 13, 1902, the canal and harbor constituted two works; by this act they were consolidated.

(*a*) *Canal.*—In its natural condition Lake Michigan was separated from Sturgeon Bay, an arm of Green Bay, by a neck of land about 1⅛ miles wide, having a maximum elevation above the lake level of about 28 feet. The Sturgeon Bay and Lake Michigan Ship Canal and Harbor Company from 1872 to 1881 constructed across this neck a canal, without locks or gates, 7,200 feet long, 100 feet wide at water surface, and 14 feet deep, and in continuation of the canal dredged a channel in Sturgeon Bay 6,100 feet long, of about same dimensions as the canal. Of the 14,400 linear feet of canal banks, 8,437 feet was provided with pile revetments. The United States assumed possession of the canal April 25, 1893.

The project adopted in 1894 and modified in 1896 provides for completing the revetments; widening the canal to 160 feet, except the westerly 1,000 feet, which is to be 250 feet wide between revetments, with a channel width of 200 feet; and a channel 15 feet deep.

To complete the modification of 1896 there remains to be built 700 feet of revetments and increasing the width of the canal from 130 feet to 160 feet for a distance of 234 feet.

(*b*) *Harbor.*—Before the construction of this harbor was undertaken the Lake Michigan entrance to the Sturgeon Bay and Lake Michigan Ship Canal was entirely unprotected from storms from northeast to southwest.

The project of constructing a harbor of refuge at this point was adopted in 1873 and modified in 1879 and 1880. The modified project, as carried out and completed in 1884, consisted of two piers, each 1,344 feet long, 850 feet apart at the shore line, protecting the lake entrance to the canal and converging so as to make the harbor entrance 335 feet wide, and inclosing an area of about 10 acres, with a depth of at least 17 feet.

The amount expended on the foregoing projects to June 30, 1902, was $349,119.26.

(*c*) *Canal and harbor.*—The existing project adopted by act of Congress approved June 13, 1902, provides for maintenance, and for increasing the depth of channel to 21 feet from Lake Michigan to Sturgeon Bay; estimated cost, $222,000. There were no operations or expenditures on this project up to June 30, 1902.

The depth of channel in the canal is 15 feet and in the harbor 17 feet.

The maximum draft that could be carried June 30, 1902, was 14.5 feet in the canal and 16 feet in the harbor.

The mean annual variation in level of water surface is 0.99 foot.

The commercial statistics indicate that the volume of commerce is large and of a general character.

For more extended information and maps, see Annual Reports of the Chief of Engineers for 1893, pages 2714–2720, and for 1896, pages 2471–2483.

For report on examination and survey see House Doc. No. 117, Fifty-sixth Congress, second session.

Commercial statistics for 1901.—Number of vessels passing through canal, 3,762; tonnage, 906,138; estimated value of cargoes, $22,469,-101.85; number of vessels seeking shelter, 283; tonnage, 69,244; number of passengers passing through canal, 16,241; increase in value of cargoes in 1901, compared with 1900, $6,494,271.36.

July 1, 1901, balance unexpended:		
Sturgeon Bay Canal	$2,082.49	
Harbor of refuge, Sturgeon Bay	368.81	
		$2,451.30
Miscellaneous receipts		107.15
Amount appropriated by river and harbor act approved June 13, 1902		44,000.00
		46,558.45
June 30, 1902, amount expended during fiscal year		1,055.06
July 1, 1902, balance unexpended		45,503.39
Amount (estimated) required for completion of existing project		178,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902		178,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

(See Appendix J J 4.)

5. Operating and care of Sturgeon Bay and Lake Michigan Ship Canal, Wisconsin.—Under an allotment from the indefinite appropriation of July 5, 1884, for operating and care of canals and other works of navigation, there was expended during the fiscal year ending June 30, 1902, $16,810.21. The principal work was the renewal and repairs to canal revetments, and dredging. Additional riprap was deposited for the protection of the exterior revetments, the premises in the vicinity of the office and other buildings were graded and otherwise improved, and needed repairs were made to the buildings and the pile-driving plant, and 33,696 cubic yards of material dredged from the canal.

Navigation through the canal opened April 18, 1901, closed by ice December 20, and resumed April 4, 1902.

For commercial statistics see report upon improvement of Sturgeon Bay and Lake Michigan Ship Canal and harbor of refuge connected therewith.

(See Appendix J J 5.)

6. Ahnapee Harbor, Wisconsin.—Previous to the improvement of this harbor the depth of water at the mouth of the Ahnapee River was only 3 feet, and the present harbor was not available for purposes of commerce.

The original project adopted in 1875 provided for the formation of a small artificial harbor connected with the lake by a channel 100 feet wide and 13 feet deep, by pier construction, dredging, and rock removal.

Amount expended on original and modified projects prior to operations under existing projects, $180,033.50.

The project adopted by Congress by act approved March 3, 1899, provides for extending the 13-foot channel, for a width of 50 feet, a distance of 800 feet, by rock removal and dredging. Estimated cost, $19,266.

The piers are built to their projected length, and channel between them dredged to the required depth of 13 feet. Recent soundings indicate that shoaling has reduced the governing depth to 11.8 feet.

The extension of channel provided for by project of 1899 is only partially completed. Its depth is 10 feet; least width, 30 feet for a distance of 520 feet.

The amount expended up to June 30, 1902, was $15,350.23, of which

$13,000 was for rock removal and dredging under existing project, and $2,350.23 for maintenance.

The maximum draft that could be carried June 30, 1902, was about 10.8 feet. The mean annual variation in level of water surface is 0.99 foot.

The volume of commerce benefited is small and of a local character.

For more extended information and maps see Annual Report of the Chief of Engineers for 1876, pages 346–363; 1888, page 1846, and 1896, page 2483.

For report on examination and survey, see House Doc. No. 172, Fifty-fourth Congress, second session.

Commercial statistics for 1901.—Arrivals of vessels, 770; exports and imports, 76,119 tons.

July 1, 1901, balance unexpended	$1,044.72
Amount appropriated by river and harbor act approved June 13, 1902	10,000.00
	11,044.72
June 30, 1902, amount expended during fiscal year	208.45
July 1, 1902, balance unexpended	10,836.27

(See Appendix J J 6.)

7. Kewaunee Harbor, Wisconsin.—The original entrance to the Kewaunee River was not more than 20 feet wide, with a depth of about 3 feet at its shoalest point, and was obstructed by submerged bowlders. The present harbor was, therefore, not available for purposes of commerce.

The original project for its improvement, adopted in 1881, which is the existing project, provided for an artificial entrance channel 15 feet deep, located about 2,000 feet south of the river mouth, protected by two parallel piers 200 feet apart, extending from the shore to the 19-foot contour in the lake. Estimated cost, $200,000. The project was completed in 1898 at a cost of about $150,000.

The amount expended up to June 30, 1902, was $158,322.71.

The maximum draft that could be carried June 30, 1902, was about 14 feet. The mean annual variation in level of water surface is 0.99 foot.

The commercial statistics indicate that the volume of commerce benefited is quite large and that it is of a general character.

For more extended information and maps, see Annual Report of the Chief of Engineers for 1881, page 2084, and for 1897, page 2675.

For report on examinations and survey see House Doc. No. 362, Fifty-sixth Congress, first session.

Commercial statistics for 1901.—Arrivals of vessels, 1,285; exports and imports, 725,768 tons.

July 1, 1901, balance unexpended	$557.90
Miscellaneous receipts	38.19
Amount appropriated by river and harbor act approved June 13, 1902	11,000.00
	11,596.09
June 30, 1902, amount expended during fiscal year	66.61
July 1, 1902, balance unexpended	11,529.48

(See Appendix J J 7.)

8. Two Rivers Harbor, Wisconsin.—The original depth of the entrance to Twin Rivers was from 3 to 4 feet, and the present harbor was not available for purposes of commerce.

The original project adopted in 1870 provided for the formation of a channel of navigable width and 13 feet deep, connecting Twin Rivers with Lake Michigan by building parallel piers extending to the 19-foot contour and dredging between them.

In 1897 the piers terminated at the 14-foot contour, and a modification then adopted provided for abandoning their further extension. At that date a channel of the required depth had been obtained at an expenditure of $214,500.

The total expenditure to June 30, 1902, was $222,019, of which $7,519 was for maintenance.

The maximum draft that could be carried June 30, 1902, was about 12 feet. The mean annual variation in level of water surface is 0.99 foot.

The volume of commerce benefited is small and of a local character.

For more extended information and maps, see Annual Report of the Chief of Engineers for 1896, page 50; 1893, page 2728; and 1896, page 2489.

For report on examination and survey, see House Doc. No. 45, Fifty-sixth Congress, first session.

Commercial statistics for 1901.—Arrivals of vessels, 1,112. Exports and imports, tons, 214,307.

July 1, 1901, balance unexpended	$1.279.45
Amount appropriated by river and harbor act approved June 13, 1902	20,000.00
	21,279.45
June 30, 1902, amount expended during fiscal year	798.45
July 1, 1902, balance unexpended	20,481.00

(See Appendix J J 8.)

9. Manitowoc Harbor, Wisconsin.—The original depth of water at the mouth of the Manitowoc River was about 4 feet at the shoalest point, and the existing harbor was not available for purposes of commerce.

The original project adopted in 1854 provided for building parallel piers 220 feet apart and dredging between them to obtain a channel 12 feet in depth connecting Manitowoc River with Lake Michigan. It was subsequently modified to increase the depth of channel to 20 feet, and to protect the same from northeast seas by a breakwater 400 feet long. These projects were completed at an expenditure of $401,827.75.

The existing project adopted by Congress by act approved June 13, 1902, provides for extending the breakwater 400 feet at an estimated cost of $37,000, for a survey, and for maintenance to June 30, 1903; estimated cost, $8,000. There were no operations or expenditures under this project up to June 30, 1902.

The maximum draft that could be carried June 30, 1902, was about 19 feet.

The volume of commerce benefited is large, and is of a general character.

For more extended information and maps, see Annual Report of the Chief of Engineers for 1876, pages 52–58; 1888, page 1851, and for 1893, page, 2731

For reports on examinations and surveys, see House Docs. No. 300, Fifty-fourth Congress, first session, and No. 233, Fifty-sixth Congress, first session.

Commercial statistics for 1901.—Arrivals of vessels, 2,143; exports and imports, 2,069,720 tons.

July 1, 1901, balance unexpended	$1,977.32
Miscellaneous receipts	32.22
Amount appropriated by river and harbor act approved June 13, 1902	45,000.00
	47,009.54
June 30, 1902, amount expended during fiscal year	24.57
July 1, 1902, balance unexpended	46,984.97

(See Appendix J J 9.)

10. Sheboygan Harbor, Wisconsin.—The depth of water over the bar at the mouth of the Sheboygan River did not originally exceed 7 feet, and the present harbor was not available for purposes of commerce.

The original project, adopted in 1866, provided for extending the piers built by the city and county of Sheboygan, and for a channel between them 13 feet deep. Subsequent modifications provided for extending the piers and increasing depth of channel to 19 feet.

The amount expended on original and modified projects prior to operations under present project is $393,734.

The existing project, adopted by acts of March 3, 1899, and June 13, 1902, provides for a breakwater 700 feet long, for extending both harbor piers, and for a channel 21 feet deep. Estimated cost, $152,000 (see House Docs. No. 327, Fifty-fourth Congress, second session, and No. 53, Fifty-fifth Congress, third session; also Annual Report of the Chief of Engineers for 1901, page 2932).

The total amount expended on existing project up to June 30, 1902, is $78,020.

Six hundred feet of the breakwater has been completed, but no work has yet been done on pier extension or increasing depth of channel.

The maximum draft that could be carried June 30, 1902, was 18 feet. The usual mean annual variation of level of water surface is 0.99 foot.

Commercial statistics for 1901.—The commerce of Sheboygan is quite large and general in its character. Arrivals of vessels, 1,042; exports and imports, 1,238,677 tons.

July 1, 1901, balance unexpended	$4,452.89
Amount appropriated by river and harbor act approved June 13, 1902	90,000.00
	94,452.89
June 30, 1902, amount expended during fiscal year	1,357.98
July 1, 1902, balance unexpended	93,094.91

(See Appendix J J 10.)

11. Port Washington Harbor, Wisconsin.—The natural channel at the mouth of the Sauk River was narrow, and at the shoalest point had a depth of 1 foot, and the present harbor was not available for purposes of commerce.

The project, adopted in 1869 and modified in 1876, provides for a channel 13 feet deep between parallel piers 150 feet apart, and for two interior basins having a depth of 13 feet and a combined area of about

5¾ acres; estimated cost, $181,527.17 (see Annual Reports of the Chief of Engineers for 1876, Vol. 2, p. 379, and for 1881, p. 2109).

The existing project was completed in 1895 at a cost of $184,848.39; since that time $12,980.25 has been expended for maintenance, etc., making a total to June 30, 1902, of $197,828.64.

The maximum draft that could be carried June 30, 1902, was 12 feet. The usual mean annual variation of levels of water surface is 0.99 foot.

Commercial statistics for 1901.—Arrivals of vessels, 1,250; imports, 70,523 tons; departures of vessels, 1,250; exports, 5,957 tons.

July 1, 1901, balance unexpended	$1,107.86
Amount appropriated by river and harbor act approved June 13, 1902	6,000.00
July 1, 1902, balance unexpended	7,107.86

(See Appendix J J 11.)

12. Milwaukee Harbor, Wisconsin, including harbor of refuge.—Milwaukee Harbor and the harbor of refuge, which were originally separate works, were consolidated by the act of June 13, 1902.

The original depth of water at the mouth of Milwaukee River was not more than 4½ feet, and the present harbor was not available for purposes of commerce. Milwaukee Bay, in which the harbor of refuge is located, is protected by the coast from storms except those from the northeast to the southeast, and, while the anchorage ground is good, vessels were in danger of dragging their anchors or of failing to effect anchorage at the proper place.

The original project for the improvement of Milwaukee Harbor was adopted in 1845-46, and provided for dredging the original river mouth and protecting the entrance by parallel piers. Subsequent modifications provided for the abandonment of the improvement of the original river mouth, and for the formation of a channel 19 feet deep through the point overlapping the mouth of the river and about 3,000 feet northerly from original outlet, the channel to be protected by parallel piers.

The amount expended on the original and modified projects prior to operations under the present project is $402,752.28, of which $50,400 was expended at original mouth of river. (See House Doc. No. 61, Fifty-fourth Congress, second session.)

The existing project, adopted by act of March 3, 1899, provides for a channel 21 feet deep, minimum width between the piers to be 200 feet, and the width outside of the pierheads to be 600 feet; estimated cost, $12,000, and $3,000 annually for maintenance.

The project for the harbor of refuge was adopted in 1881, and provides for a breakwater 7,650 feet long, including an opening therein of 400 feet. Original estimated cost, $800,000 (see Annual Report of the Chief of Engineers for 1881, p. 2116 et seq.); revised estimate, $955,650 (see Annual Reports of the Chief of Engineers for 1896, p. 2504, and for 1897, p. 2690).

The total amount expended on existing projects to June 30, 1902, is $959,464.67, of which $939,153.50 is for breakwater, $12,000 for 21-foot channel, and $8,311.17 for maintenance.

The existing projects for both the harbor and harbor of refuge are completed, the full projected depth of channel having been secured and the breakwater built to its full projected length.

The maximum draft that could be carried June 30, 1902, was 20 feet. The mean annual variation of level of water surface is 0.99 feet.

Commercial statistics for 1901.—Arrivals of vessels, 5,488; imports, 3,031,163 tons; departures of vessels, 5,719; exports, 1,006,434 tons.

The act of June 13, 1902, provides for rebuilding the older portion of the superstructure of the breakwater and the superstructure of a portion of the north harbor pier with concrete.

July 1, 1901, balance unexpended:		
Harbor of refuge, Milwaukee Bay	$20,709.29	
Milwaukee Harbor	8,540.77	
		$29,250.06
Miscellaneous receipts		149.31
Amount appropriated by river and harbor act approved June 13, 1902		232,500.00
		261,899.37
June 30, 1902, amount expended during fiscal year		5,991.65
July 1, 1902, balance unexpended		255,907.72

(See Appendix J J 12.)

13. South Milwaukee Harbor, Wisconsin.—The entrance to this harbor originally varied in depth from absolute closure to about 5 feet, and the harbor was not available for purposes of commerce.

The original project of improvement, and which is the existing project, was adopted in 1896, and provides for a channel 18 feet deep, 200 feet wide between parallel piers; estimated cost, $138,000; published in Annual Report of the Chief Engineers for 1895, page 2641 et seq.

The total amount expended on existing project up to the close of the fiscal year ending June 30, 1902, is $4,792.84.

The north pier, originally built by private parties, has been extended 185 feet. No dredging has been done, and the harbor in its present condition is not available for commerce.

Commercial statistics for 1901.—There have been no arrivals or departures of vessels.

A resurvey of this harbor was ordered by act of June 13, 1902. The survey will be made and report with plans and estimates submitted at an early day.

July 1, 1901, balance unexpended	$207.16
July 1, 1902, balance unexpended	207.16

(See Appendix J J 13.)

14. Racine Harbor, Wis.—The entrance to this harbor originally varied in depth from absolute closure after storms to about 7 feet, and the present harbor was not available for purposes of commerce.

The original project, adopted in 1842–43, provided for a channel 13 feet deep between parallel piers, 160 feet apart. Subsequent modifications provided for extending the piers and increasing the depth of channel to 17 feet.

The amount expended on original and modified projects, prior to operations under present project, is $336,747.26.

The existing project, adopted by act of March 3, 1899, provides for extending the south pier, building 600 feet of breakwater, and increasing depth in channel to 21 feet; estimated cost, $117,650; published in House Docs. No. 326, Fifty-fourth Congress, second session, and No. 165, Fifty-fifth Congress, third session.

The total amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1902, not including outstanding liabilities, is $116,289.36.

The full projected depth in channel has now been secured and the

existing project is completed with the exception of a change in location and direction of breakwater, authorized by act of June 13, 1902.

The maximum draft that could be carried June 30, 1902, was 20 feet. The usual mean annual variation of level of water surface is 0.99 foot.

Commercial statistics for 1901.—Arrivals of vessels, 1,770; exports and imports, 516,531 tons.

July 1, 1901, balance unexpended	$5,687.09
Miscellaneous receipts	72.56
Amount appropriated by river and harbor act approved June 13, 1902	20,000.00
	25,759.65
June 30, 1902, amount expended during the fiscal year	4,288.71
July 1, 1902, balance unexpended	21,470.94

(See Appendix J J 14.)

15. Kenosha Harbor, Wisconsin.—The original depth of water at the mouth of Pike Creek varied from nothing to 4 feet, and the present harbor was not available for purposes of commerce.

The original project adopted in 1852 provided for a channel 13 feet deep between parallel piers 150 feet apart. Subsequent modifications provided for extending the piers, increasing the depth of channel to 16 feet, and for dredging in the basin.

The amount expended on original and modified projects prior to operations under present project is $298,012.

The existing project, adopted by act of March 3, 1899, provides for extending the south pier, increasing the width between piers to 250 feet by rebuilding the north pier, building 600 feet of breakwater, and increasing depth in channel and basin to 21 feet and 20 feet, respectively. Estimated cost $191,000. Published in House Docs. No. 328, Fifty-fourth Congress, second session, and No. 164, Fifty-fifth Congress, third session.

The total amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1902, not including outstanding liabilities, is $173,421.63.

The full projected depth in both channel and basin has been secured, and the existing project is now completed with the exception of a change in location and direction of the breakwater, authorized by act of June 13, 1902.

The maximum draft that could be carried June 30, 1902, was 19 feet. The usual mean annual variation of level of water surface is 0.99 foot.

Commercial statistics for 1901.—Arrivals of vessels, 365; imports, 119,782 tons; departures of vessels, 363; exports, 14,896 tons.

July 1, 1901, balance unexpended	$16,218.95
Miscellaneous receipts	157.71
Amount appropriated by river and harbor act approved June 13, 1902	5,000.00
	21,376.66
June 30, 1902, amount expended during fiscal year	3,345.17
July 1, 1902, balance unexpended	18,031.49

(See Appendix J J 15.)

16. Waukegan Harbor, Illinois.—There was no navigable channel or natural harbor at this place.

The original project was adopted in 1880, and provided for an artificial harbor of sufficient capacity for local trade, by inclosing a portion of Lake Michigan with pile piers, the entrance channel and inclosed area to be dredged to 13 feet.

The amount expended on original and modified projects prior to commencement of operations under present project was $218,944.41.

The existing project, adopted by act of June 13, 1902, and published in House Doc. No. 343, Fifty-sixth Congress, first session, provides for extending both harbor piers, building a breakwater, and increasing depth of channel to 20 feet; estimated cost, $345,000.

No work had been done, and no expenditures had been made under the new project up to the close of the fiscal year ending June 30, 1902.

The maximum draft that could be carried June 30, 1902, was 16 feet, the increased depth of channel over projected depth of 13 feet having been obtained by private enterprise.

The usual mean annual variation of level of water surface is 0.99 foot.

Commercial statistics for 1901.—Arrivals of vessels, 656; imports, 104,628 tons; departures of vessels, 655; exports, 5,801 tons.

July 1, 1901, balance unexpended	$4,753.86
Amount appropriated by river and harbor act approved June 13, 1902	100,000.00
	104,753.86
June 30, 1902, amount expended during fiscal year	3,198.27
July 1, 1902, balance unexpended	101,555.59
Amount (estimated) required for completion of existing project	245,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	245,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix J J 16.)

17. Fox River, Wisconsin.—The Fox and Wisconsin rivers, separated at Portage City, Wis., by a distance of only 2 miles, one flowing into Lake Michigan, the other into the Mississippi River, were the early means of communication between those waters. In 1846 Congress granted to the State of Wisconsin a quantity of land for the purpose of improving the navigation of this route. By means of a board of public works the State began and carried on the improvement until 1853, when it was transferred to a private company. In 1872 the United States acquired possession of the property, with the exception of the water power, water-power lots, and personal property. The earliest project, that of 1848, called for canals 40 feet wide at bottom and 4 feet deep, with locks 125 feet long and 30 feet wide. This project was enlarged subsequently. The present project is that of a Board of Engineers submitted September 17, 1884, and modified May 14, 1886. It provides for deepening and widening the channel of the Fox River from Green Bay to Montello to 6 feet depth and 100 feet width, and from Montello to Portage to 4 feet depth, and for the renovation of 12 old locks.

The amount expended on the Fox and Wisconsin rivers from 1867 to the close of the fiscal year ending June 30, 1902, including $145,000

paid to the Green Bay and Mississippi Canal Company for its property, was $3,093,084.01, of which amount $428,084.01 was appropriated solely for and expended solely upon the Fox River since 1885.

The result of this expenditure upon the Fox River was the construction of 16 new stone locks, 10 composite locks, 16 permanent dams, 12 canals, a head wall and feeder at the old first lock at Appleton, a lock house at Appleton, warehouse at Appleton first lock and Berlin lock, a wing dam and brush and stone shore protection to the Portage levee, masonry wasteweirs at Little Chute combined locks and Appleton third lock, masonry culvert at head of Little Chute combined locks, a dry dock at Kaukauna, guard gates at head of Kaukauna Canal; also rebuilding canal banks at Kaukauna, wing walls at Kaukauna fourth lock, and 1,237 linear feet of cement-laid rubble-core wall in canal banks of fourth and fifth levels. A channel 75 feet wide and 450 feet long has been secured by blasting and drilling the rock bar below Depere lock from 4 to 12 inches below the top of the lower miter sill. Channel below Depere has been deepened and channel deepened at mouth of Fondulac River, Neenah channel, Fox River at head of Lake Butte Des Morts, Grignon Rapids, below Little Chute and Rapide Croche locks, and in the canals and Upper Fox River. Masonry outlet to wasteweir at Kaukauna second lock, a roadway upon the United States property at Appleton first lock, and fishways in the Eureka, Berlin, White River, Princeton, Grand River, Montello, and Fort Winnebago dams have been constructed. A harbor of refuge has been constructed at Stockbridge Landing, Lake Winnebago, and snags have been removed and bars dredged in Wolf River, making a 4½-foot channel 100 feet wide to New London.

The improvement of Wisconsin River was abandoned in 1887.

The full depth of 6 feet has now been obtained from Depere to White River lock, with the exception of about three-fourths of a mile between mileposts 34 and 35, a distance of 99 miles from mouth of Fox River. Above this point the projected depth and width have not yet been obtained.

The expenditures during the fiscal year ending June 30, 1902, were for superintendence.

The relative value of the commerce involved and the cost of the improvement can not be estimated.

Its principal effect so far has been to cause some reduction in freight rates to points in the Fox River Valley. Deepening the channel of the Upper Fox River by dredging has also had, and will continue to have, the effect of draining the enormous expanse of meadow lands in the Fox River Valley and greatly increasing their availability and value.

The maximum draft that could be carried June 30, 1902, at mean low water over the shoalest part of the improvement was from Depere to White River lock, 6 feet; from that point to Montello, 4 feet, and from Montello to Portage, 3 feet.

July 1, 1901, balance unexpended	$6,925.32
Miscellaneous receipts	20.00
Amount appropriated by river and harbor act approved June 13, 1902	70,000.00
	76,945.32
June 30, 1902, amount expended during fiscal year	259.33
July 1, 1902, balance unexpended	76,685.99

(See Appendix J J 17.)

18. Operating and care of locks and dams on Fox River, Wisconsin.—Under an allotment from the indefinite appropriation for operating and care of canals and other works of navigation, there has been expended during the year ending June 30, 1902, the sum of $63,550.30.

The principal work has been dredging bars and channels, making repairs of locks, dams, canal banks, lock houses, dredges, and boats; rebuilding Montello lock; rebuilding Portage lock, raising walls of old Portage lock to height of new lock, and building a pile revetment at entrance from Wisconsin River to Portage lock; building shore protections to sand banks on Upper Fox, and care of works and property.

A detailed statement, appended to the report of the local engineer officer in charge, shows the items of expenditures.

Navigation was closed November 25, 1901, and reopened April 10, 1902. The water in Lake Winnebago and the Lower Fox has been maintained at the crests of the dams throughout the year, with the exception of Lake Winnebago during the close of navigation, drawn down by the mills with permission of the Secretary of War.

For commercial statistics see report of the local officer upon improvement of Fox River, Wisconsin.

(See Appendix J J 18.)

IMPROVEMENT OF CHICAGO AND CALUMET HARBORS, ILLINOIS, OF CHICAGO RIVER, ILLINOIS, AND OF CALUMET RIVER, ILLINOIS AND INDIANA.

The works in this district were in the charge of Maj. J. H. Willard, Corps of Engineers, to October 31, 1901, and of Lieut. Col. O. H. Ernst, Corps of Engineers, since that date. Division Engineer, Col. S. M. Mansfield, Corps of Engineers, to July 24, 1901, and Lieutenant-Colonel Ernst from July 24 to October 31, 1901.

1. Chicago Harbor, Illinois.—The present project was adopted in 1870 and modified in 1878, and contemplated—

(*a*) The formation of an outer harbor by inclosing a portion of Lake Michigan just south of the entrance to Chicago River by breakwaters, and dredging the same, for the purpose of increasing the harbor facilities of Chicago.

(*b*) The construction of an exterior breakwater in deep water in Lake Michigan, north of the entrance to Chicago River and about 1 mile distant therefrom, to shelter the approaches to the river and outer harbor and to form a harbor of refuge near the southern end of Lake Michigan.

(*c*) To keep the entrance to Chicago River dredged for the passage of vessels navigating the Chicago River as far as to the original shore line of Lake Michigan, at or near Rush Street Bridge.

The river and harbor act of March 3, 1899, further modified the project of 1870 by providing for dredging the outer basin and harbor entrance to 20 feet depth at low water.

There had been expended upon this project up to June 30, 1902, $1,871,320.44.

All of the work under the projects of 1870 and 1878 has been completed except dredging the outer basin.

A contract was in force at the beginning of the year for dredging the Chicago River from Rush street eastward, for removing the bar at the entrance to the river, and for dredging the inner harbor or basin

so far as the funds will permit. Work under this contract began May 2, 1901, and at the close of the fiscal year an aggregate of 826,008 cubic yards had been removed, resulting in a 21-foot channel in the river from the Rush Street Bridge to the lake and the same depth over the bar at the harbor entrance and over an anchorage ground extending southwardly from the river a distance of 1,920 feet for a width of 1,150 feet, comprising an area of about 50 acres.

July 1, 1901, balance unexpended	$94,578.60
Amount received from sale of property	291.00
	94,869.60
June 30, 1902, amount expended during fiscal year	[a]55,268.88
July 1, 1902, balance unexpended	39,600.72
July 1, 1902, amount covered by uncompleted contracts	38,029.56

(See Appendix K K 1.)

2. Chicago River, Illinois.—This river, as far as its navigable water extends, is entirely within the limits of the city of Chicago, Ill. Prior to the fiscal year ending June 30, 1896, no work had been done for the improvement of its navigation by the United States. The project inaugurated by Congress under the act of June 3, 1896, as modified by the act of June 4, 1897, contemplated the improvement of the river by dredging and minor changes of docks and dock lines to admit passage by vessels drawing 16 feet of water. This project has been completed.

The river and harbor act of August 18, 1894, allowed $25,000 from the appropriation made for the improvement of Chicago Harbor to be applied to the improvement of Chicago River between the mouth of the river and the junction of the two branches, of which amount $3,645.70 was expended in the year ending June 30, 1896, in dredging to 18 feet depth as far as to Rush Street Bridge. Since the passage of the act of June 3, 1896, the balance of this amount has been transferred to the Chicago River work.

Up to the close of the fiscal year ending June 30, 1902, there had been expended $423,520.51, excluding the $25,000 allotted as above stated. As a result of this expenditure, the river has been dredged to a depth of 17 feet below Chicago city datum, from the mouth of the river to Ashland avenue on the South Branch and West Fork, and to the stock yards on the South Fork, South Branch, a distance of about 6 miles, and to Belmont avenue on the North Branch, the head of navigation. The titles to all of the lands (17 tracts) to be removed under the project for widening and deepening the river were secured at a total cost of $91,949.50. The total amount of material removed was 1,998,561 cubic yards.

By the act of June 13, 1902, Congress provided for two turning basins.

July 1, 1901, balance unexpended	$224,991.52
Amount appropriated by river and harbor act approved June 13, 1902	306,457.00
Amount received from sale of property	18.12
	531,466.64
June 30, 1902, amount expended during fiscal year	[a]23,512.03
July 1, 1902, balance unexpended	507,954.61

(See Appendix K K 2.)

[a] Includes $500 for expenses of Office Chief of Engineers.

3. Calumet Harbor, Illinois.—This harbor is known on the Great Lakes as South Chicago Harbor.

This improvement was designed to furnish a safe and practicable entrance to Calumet River and the port of South Chicago by the construction of parallel piers 300 feet apart projecting from the shore into Lake Michigan, and by dredging between them.

The work began in 1870, and all the projected work had been accomplished for 16-foot draft prior to June 30, 1896, resulting in the construction of 3,640 linear feet of north pier and 2,020 linear feet of the south pier and securing and maintaining a channel 16 feet deep and of suitable width from similarly deep water in Lake Michigan to the Calumet River at the roots of the piers, at a cost of $454,483.53. The work included also 476,564 cubic yards of material dredged, increasing the depth in the channel from 7 to 16 feet.

On June 30, 1896, it may be considered that the original project for this locality was terminated and completed.

Under date of February 21, 1896, a plan for improvement of both the inner and outer harbors was submitted. The estimated cost of this improvement was $1,134,830. (Annual Report of the Chief of Engineers for 1896, p. 2583.)

The expenditures to June 30, 1902, were $855,764.98.

Under the project of February 21, 1896, for construction of the outer harbor of refuge, adopted by Congress in the river and harbor act of March 3, 1899, work was in progress under contract at the close of the fiscal year ending June 30, 1901. By June 30, 1902, there had been placed in all 4,400 linear feet of foundation, 44 cribs constructed, 42 cribs sunk and filled with stone, 3,400 feet of superstructure built, 4,187 linear feet of ice guard placed, and 327,978 cubic yards of dredging removed from the area sheltered by the new breakwater.

July 1, 1901, balance unexpended	$439,500.16
Amount received from sale of property	1.00
Amount appropriated by sundry civil act approved June 28, 1902	215,000.00
	654,501.16
June 30, 1902, amount expended during fiscal year	167,515.14
July 1, 1902, balance unexpended	486,986.02
July 1, 1902, amount covered by uncompleted contracts	229,867.20
Amount (estimated) required for completion of existing project	204,480.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	204,480.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix K K 3.)

4. Calumet River, Illinois and Indiana.—The project for the improvement of this river, adopted by Congress in 1884 and modified in 1886, contemplated securing a channel 200 feet in width and 16 feet in depth below low water in Lake Michigan, from the mouth of Calumet Harbor, Illinois, to one-half mile east of Hammond, Ind.

The project was modified by the river and harbor act of June 3, 1896, so as to provide for dredging the channel for 2 miles southward from the mouth of the river to 20 feet depth.

Under the project of 1884 their was dredged a channel, measured from the harbor southward, to the full width of 200 feet and depth of 16 feet, 19,518 feet in length, except that over a short portion where

rock was encountered the width was reduced to 85 feet and the depth to 14 feet.

In addition there was removed 248,516 cubic yards of material from the channel between "The Forks" and one-half mile east of Hammond, Ind., in an effort to secure a practicable channel 10 feet deep and 60 feet wide, resulting in failure, due to rapid refilling of channel.

Under the supplementary project of 1896 there had been 320,405 cubic yards of material removed under contract, completing the channel 20 feet deep a distance of 2 miles, and providing a winding or turning basin 20 feet deep at the first cut-off above the mouth of the river.

The expenditures to June 30, 1902, amounted to $399,982.86.

Winding or turning basins should be provided at intervals of from 1 to 2 miles along the river.

The river and harbor act of June 13, 1902, appropriated $75,000 for the improvement of this stream, and provided for an extension of the 20-foot channel from One hundred and sixth to One hundred and twenty-second streets, a distance of 2.2 miles, and for the resumption of the work above "The Forks." The officer in charge points out that no useful results can be obtained from expenditures above "The Forks."

July 1, 1901, balance unexpended	$13,360.30
Amount appropriated by river and harbor act approved June 13, 1902	75,000.00
	88,360.30
June 30, 1902, amount expended during fiscal year	[a] 3,343.16
July 1, 1902, balance unexpended	85,017.14

(See Appendix K K 4.)

IMPROVEMENT OF ILLINOIS RIVER, ILLINOIS AND INDIANA, AND CONSTRUCTION OF ILLINOIS AND MISSISSIPPI CANAL.

This district was in the charge of Maj. J. H. Willard, Corps of Engineers. Division Engineer, Col. S. M. Mansfield, Corps of Engineers, to July 24, 1901, and Lieut. Col. O. H. Ernst, Corps of Engineers, since that date.

1. Illinois River, Illinois.—The project, which contemplates the extension of the slack-water improvement begun by the State of Illinois from Copperas Creek locks to the Mississippi River, and which includes the construction of two locks 350 feet long between sills, 75 feet width of chamber, with 7 feet of water over sills at low-water level of 1879, and dredging the channel where necessary to obtain 7 feet depth at low water, was adopted in 1880.

The United States has expended on this work up to June 30, 1902, $1,445,597.80, of which $15,442.08 was expended during the fiscal year in widening the channel to 200 feet between Kampsville lock and the mouth of the river, removing snags, and in care and repair of the plant.

The lock and dam at Kampsville, Ill., 31 miles above the mouth of the Illinois River, has been completed and in use since 1894; and that at Lagrange, 79 miles above the mouth, since 1890.

The State of Illinois, aided by the United States, has executed part of the general project by the construction of locks and dams at Henry

[a] Includes $1,500 for expenses of Office Chief of Engineers.

and at Copperas Creek, completing, except dredging, that part of the project between Lasalle and the mouth of Copperas Creek, a distance of about 90 miles, over which section the State of Illinois collects tolls.

July 1, 1901, balance unexpended	$31,217.49
Amount appropriated by river and harbor act approved June 13, 1902	75,000.00
	106,217.49
June 30, 1902, amount expended during fiscal year	15,442.08
July 1, 1902, balance unexpended	90,775.41
July 1, 1902, outstanding liabilities	1,250.00
July 1, 1902, balance available	89,525.41

(See Appendix L L 1.)

2. Operating and care of Lagrange and Kampsville locks, Illinois River, and approaches thereto.—These locks and dams have been operated and maintained under the indefinite appropriation provided for in section 4 of the river and harbor act of July 5, 1884.

(*a*) *Lagrange lock and dam.*—During the entire season of navigation, from July 1 to December 14, 1901, and from March 9 to June 30, 1902, the lock was used by boats, though a few passed over the dam after June 17. The tonnage at this lock was about equal to that for the preceding year.

Six thousand two hundred and ninety-four dollars and eighty-four cents was expended during the past year, exclusive of $484.50 outstanding liabilities June 30, 1902.

(*b*) *Kampsville lock and dam.*—There was no navigation through this lock between December 5, 1901, and March 8, 1902. During the remainder of the year, or throughout the navigable season, all boats passed through the lock until June 29, when high water enabled them to pass over the dam.

The business at the lock during the year 1902 was as good as any of the preceding eight years during which it has been in operation.

The expenditures during the past year, exclusive of $416.30 outstanding liabilities June 30, amounted to $5,785.21.

(See Appendix L L 2.)

3. Illinois and Mississippi Canal, Illinois.—The object of the improvement is to furnish a link in a navigable waterway from Lake Michigan to the Mississippi River at the mouth of Rock River, Illinois.

The canal has been located on the Rock Island route, approved by the Secretary of War October 27, 1888, as directed in the act of Congress of August 11, 1888. It proceeds from the Illinois River at its great bend, 1¾ miles above the town of Hennepin, Ill., thence via Bureau Creek Valley and over the summit to Rock River at the mouth of Green River; thence by slack water in Rock River, and a canal around the lower rapids of the river at Milan to the Mississippi River at the mouth of Rock River.

The canal is to be at least 80 feet wide at the water surface, 7 feet deep, and with locks 170 feet long and 35 feet width of lock chamber, capable of passing barges carrying 600 tons (maximum) freight.

A report upon the location, with detailed estimates of cost, of this canal was submitted June 21, 1890, and published (without maps) as House Ex. Doc. No. 429, Fifty-first Congress, first session, and is also

printed in the Annual Report of the Chief of Engineers for 1890, page 2586.

The river and harbor act of September 19, 1890, made the first appropriation for the construction of the canal and directed work to be begun by the construction of one of the locks and dams in Rock River.

In accordance with this act, work was begun in July, 1892, near the mouth of Rock River, on the construction of a canal around the lower rapids of the river, and since that date has been prosecuted as rapidly as appropriation of funds permitted. The survey work in locating the canal on the ground, and proceedings for acquiring title to the right of way, have been continuous since October, 1890, and the canal has been definitely located on the ground throughout its entire extent.

There had been expended on this work up to the close of the fiscal year ending June 30, 1902, $5,066,113.25.

The result of this expenditure has been:

First. The acquisition of the right of way for 4½ miles around the lower rapids of Rock River and the completion of 4½ miles of canal there, involving the construction of 4½ miles of earthwork in constructing the canal trunk, 3 locks, 1 railroad and two highway swing bridges, 7 sluiceways and gates, 1 arch culvert, 2 dams 1,392 feet long across the arms of Rock River, 3 lock keepers' houses, 1 small office building, a thorough riprapping of the canal banks (not estimated for in the original estimates), and construction by contract of Moline wagon bridge at a cost of $25,000, which was also not included in the original estimate.

Second. In the location on the ground and preparation of descriptions, plats, and abstracts of title of all lands needed for the construction of the canal and feeder and for lands to be overflowed or damaged by the canal at Sterling.

Third. In the completion on eastern section of all earthwork miles 1 to 18 and practical completion of earthwork miles 19, 20, and 24 to 28, inclusive; the foundations and masonry for all culverts, and Locks 1 to 21; the construction of three aqueducts, ten highway and three railroad bridges, nine arch culverts and eleven pipe culverts; construction of abutments for eight additional highway bridges and placing superstructures for same under contract; the erection of five houses for superintendents and one small house for office use, and acquiring additional right of way for waste material miles 21 to 23, inclusive.

Fourth. In the acquisition, by condemnation or purchase, of all lands required for the canal, except a small amount required for approaches to bridges.

Fifth. In the construction of 4,673,008 cubic yards of earthwork on the feeder, completing all work of that character, except some cross banks and bridge approaches; completion of nine arch and ten pipe culverts; foundations and abutments for seven highway and two railway bridges and the superstructure of one double-track highway and two single-track railway bridges.

Sixth. In the acquiring of lands for right of way, including land to be damaged by overflow and land upon which to deposit waste material on the western section; construction of 2,447,207 cubic yards of earthwork, completing 16 miles and 50 per cent of 7 miles more; four arch and fourteen pipe culverts; placing under contract

foundations for four arch culverts, two locks, and four aqueduct bridges; building foundations and abutments for ten and foundations for two highway bridges; placing under contract superstructures for nineteen highway and one double-track railway bridges; building eight warehouses and one lock house, and partially completing two lock houses.

A special report, with revised estimate for completion of this improvement, was submitted by the local engineer and transmitted to Congress. It is printed in House Doc. No. 297, Fifty-seventh Congress, first session, and is herewith in Appendix L L 3.

July 1, 1901, balance unexpended	[a]$1,723,018.75
Amount appropriated by sundry civil act approved June 28, 1902	733,220.00
	2,456,338.75
June 30, 1902, amount expended during fiscal year	575,605.54
July 1, 1902, balance unexpended	1,880,633.21
July 1, 1902, outstanding liabilities	100,000.00
July 1, 1902, balance available	1,780,633.21
July 1, 1902, amount covered by uncompleted contracts	305,848.86

(See Appendix L L 3.)

IMPROVEMENT OF MICHIGAN CITY HARBOR, INDIANA, AND OF RIVERS AND HARBORS ON THE EASTERN SHORE OF LAKE MICHIGAN.

This district was in the charge of Capt. Charles Keller, Corps of Engineers. Division Engineer, Col. S. M. Mansfield, Corps of Engineers, to July 24, 1901, and Lieut. Col. O. H. Ernst, Corps of Engineers, since that date.

General statement as to the usual variations in the level of the lake surface at all the harbors on the east shore of Lake Michigan.—The level of the lake surface varies considerably from time to time. At present its maximum height may be stated as from 0.5 to 1 foot below mean low water, and obtains from the end of June to the middle of August. Its lowest stage is between 1.5 and 2 feet below mean low water, and obtains with slight change from early in November to early in April.

1. Michigan City Harbor, Indiana.—The inner and outer harbors were formerly separate works. They are now consolidated in consequence of the requirements of the river and harbor act of June 13, 1902.

The improvement of this harbor dates from 1836, and has resulted in establishing an inner harbor for local commerce and partly completing an outer harbor, designed to facilitate entrance to the former and afford refuge for vessels engaged in general lake commerce.

The inner harbor has been made by deepening the entrance to Trail Creek and protecting the channel by piers extending to deep water in Lake Michigan, to which operations were limited until 1870. The original depths before improvement were 9 feet upon the outer bar and 3½ feet or less at the entrance to the inner harbor, and the width varied from 175 feet in the lower portion to 60 feet or less in the upper portion. Since 1882 the entrance channel has been prolonged up the

[a] Three dollars paid on Treasury settlement 15333 deducted; 50 cents refunded on account of overpayment added.

creek by dredging between revetments, as they are built on established wharf lines at the expense of the adjoining property owners, as required by city ordinance. No general project for the expenditure of funds has been definitely adopted, but it seems to have been agreed that the improvement should extend upstream between banks revetted, as previously described, as far as the Lake Erie and Western Railroad bridge. A map of this portion of Trail Creek is given opposite page 2270, Annual Report of the Chief of Engineers for 1882.

In recent years the project has been purely one for maintenance, and has resulted in creating, by dredging, a channel 9,159 feet long between revetments from 100 to 175 feet apart, except at the turning basins, where the width is about 330 feet. The upper limit of this improved channel is 100 feet above the upper turning basin in the map above referred to, but above the lower part of the upper basin the channel has shoaled, and is not available for lake vessels.

The total expenditure to June 30, 1902, was $438,365.50. Of this total, $287,383.77 was expended from 1836 to 1869, inclusive, principally upon pier construction, but it is now impossible to separate the cost of maintenance for this period from that of original construction. Since 1869 $150,981.73 in all has been expended, of which $54,419.55 was applied to maintenance. As a result of the above expenditures the channel depths on June 30 were 15.3 feet from the harbor entrance to the lower basin, a distance of about 5,500 feet, above which point the depth gradually decreased to 11.1 feet at the upper basin. The maximum draft which can be carried over the shoalest point in the improved channel to the lower basin was, on June 30, 1902, 15.3 feet, and above that 11.1 feet, at mean low water.

The commerce benefited by the improvement is purely local in character, the principal business being in lumber and salt, which are brought from the northern harbors by small steam barges and by sailing vessels.

No work was done during the past year. The harbor structures aggregate 3,563 feet in length, of which a length of 735 feet of old east pier and 1,544 feet of west pier requires sheet piling and new superstructure.

The channel does not maintain itself and provision should be made for periodical dredging.

The outer harbor.—Michigan City being at the southern end of the lake, is exposed to northerly storms, especially those from west of north, with a clear sweep of the length of the lake, about 250 miles. As a result, there arose a demand for a harbor of refuge in this vicinity, which was answered in 1870 by the adoption of a project for the creation of an outer harbor at this place which was to consist of an outer basin east of the entrance to the inner harbor; in 1882 this project was extended to include the construction of an exterior breakwater northwest of the entrance. The piers and breakwaters covering the outer basin were completed in 1885, and have a total length of 3,171 feet, measured on the harbor face, viz, a pile pier 1,225 feet long extending in a northerly direction from the shore and closing the basin on the east; a crib breakwater 1,411 feet long extending westward from the lake end of the pile pier and closing the basin on the north, and a crib pier 535 feet long measured from the angle in the harbor face, or 505 feet measured from the rear face of the breakwater, extending northward from the west end of the crib breakwater. The exterior breakwater contemplated by the project of 1882 was to have

a total length of 2,000 feet, but a length of only 700 feet has been built.

The river and harbor act of March 3, 1899, authorized the adoption of the project of a Board of Engineers as printed in the Annual Report of the Chief of Engineers for 1897, pages 2899 to 2904, inclusive, and provided for the completion of the work under the continuing-contract system. This project requires the extension of the breakwater pier by 600 feet, the construction of a new detached breakwater 1,500 feet long, and the removal of the present detached breakwater.

Up to June 30, 1902, $828,600.38 had been expended upon the original project and its subsequent modifications. Of this amount $758,226.34 had been expended upon the projects of 1870 and 1882, of which $132,665.25 was applied to maintenance. Seventy thousand three hundred and seventy-four dollars and four cents in all had been expended upon the existing revised project, none of which had been applied to maintenance.

Operations under the new contract have been in progress since May 1, 1900, with the result that up to June 30, 1902, five cribs upon pile foundations had been placed in the breakwater pier, leaving one crib still to be sunk and 300 feet of superstructure to be built, and the stone foundation of the detached breakwater had been practically completed. No additional facilities for navigation have thereby been secured, and until the completion of the new work and the removal of the old detached breakwater no benefit can accrue. This project, which was originally intended to furnish a harbor of refuge for general lake commerce, will now, when completed, probably be of service only to the smaller class of vessels which serve the local traffic. The usual course traversed by the larger class of vessels leads toward Chicago and does not come within 30 miles of Michigan City.

The Annual Report of the Chief of Engineers for 1897, pages 2899 to 2904, contains in full the report of the Board of Engineers referred to above, and a map showing the outlines of the present project is opposite page 2904 of this report.

Entrances and clearances.

Calendar year.	Number.	Tonnage.	Calendar year.	Number.	Tonnage.
1888	1,153	208,617	1895	343	91,016
1889	795	169,193	1896	437	106,543
1890	921	172,817	1897	492	118,187
1891	837	168,654	1898	478	127,237
1892	1,391	443,055	1899	601	144,880
1893	1,577	589,863	1900	412	102,323
1894	389	119,929	1901	502	121,895

NOTE.—No record is kept of traffic between Michigan City and Chicago.

July 1, 1901, balance unexpended	$270,664.29
Deposit September 13, 1901, proceeds transfer of property	30.00
Amount appropriated by river and harbor act approved June 13, 1902	63,000.00
	333,694.29
June 30, 1902, amount expended during fiscal year	[a]61,496.40
July 1, 1902, balance unexpended	272,197.89
July 1, 1902, outstanding liabilites	750.00
July 1, 1902, balance available	271,447.89
July 1, 1902, amount covered by uncompleted contracts	195,918.30

(See Appendix M M 1.)

[a]Includes $200 for expenses of Office Chief of Engineers.

2. St. Joseph Harbor and River, Michigan.—These were formerly carried as separate works, but are now combined in consequence of a provision in the river and harbor act of June 13, 1902.

(*a*) *St. Joseph Harbor.*—This harbor is formed by the junction of the St. Joseph and Pawpaw rivers and extends along the city front of St. Joseph, and in its original condition had a natural width of 800 feet, which has been reduced to 300 feet by wharves built upon the approved harbor lines. It has been under improvement by the United States since 1836, previous to which time there was a narrow and crooked channel with depths which varied from 3 to 7 feet. The original project of 1836 is not clearly known. Up to 1866 there were built 1,100 feet of north pier and 212 feet of south pier, which protected a cut through the narrow tongue of land to the north of the old river mouth, the width between the piers being 240 feet, which became 257 feet through subsequent repairs. In all $162,113 was expended upon this work. In 1866 the first definitely known project was adopted, and this proposed the extension of the south pier 200 feet for the purpose of facilitating the creation of a direct channel of 16 feet depth through the bar at the entrance. The project of 1866 was modified in 1874, 1875, 1880, and 1892, the changes having reference principally to the length and direction of the two piers. The Benton Harbor Canal, which is about 1 mile long and extends from the upper part of the harbor to the town of Benton Harbor, was taken over by the United States for the purpose of care, maintenance, and improvement. In all there was expended upon these various projects $503,113.23.

The river and harbor act of March 3, 1899, adopted the present project, which is printed in the annual report for 1898, pages 2496–2498. This project provides for an entrance channel 18 feet deep and for an interior channel 18 feet deep and 150 feet wide along the city front of St. Joseph, while the Benton Harbor Canal and the turning basin at the mouth of the St. Joseph River are to be dredged to 15 feet. The north pier is to be extended 1,000 feet, and the south pier, upon a line parallel to the north pier, 1,800 feet. The width between will be 330 feet at the entrance, narrowing to 257 feet inside. The estimated cost of completion of the existing project was given in the above report at $380,000. Up to June 30, 1902, there had been expended upon the existing project $119,180.87, of which $17,638.70 had been applied to the repairs of the south pier provided for by the project. Operations since June, 25, 1900, have been in progress for the purpose of completing all the work contemplated. As a result of the above expenditures 300 feet had been added to the north pier and 1,100 feet to the south pier, and in November, 1901, the proposed dredging had been completed so far as at present practicable. Slight deterioration in the dredged channels has since taken place, but between the piers in St. Joseph Harbor and in the canal there nevertheless is found a channel of the projected width and depth. The bar just beyond the ends of the piers still persists and limits the maximum through draft to 16.6 feet. To complete the existing project the dredging through this bar still remains to be done.

The principal traffic benefited by this improvement is the fruit traffic and the carrying of passengers, including excursionists to the summer resorts in this vicinity. Both classes of traffic show continuous growth. The entire traffic is served by a single line of steamers, which, however, during the summer, runs from two to four boats daily, some of these being of very great size.

House Doc. No. 307, Fifty-fifth Congress, second session, reproduces a map accompanying the present revised project, which is not republished in the Annual Report of the Chief of Engineers for 1898.

(*b*) *St. Joseph River.*—This is a crooked stream, obstructed by numerous shoals, with depth in channel crossings of from 24 to 30 inches. The intervening pools are generally from 4 to 8 feet deep. The part under improvement is from the mouth, at St. Joseph, to Berrien Springs, a distance of about 25 miles by river. The improvement of this section to make a low-water channel 3 feet deep has been in progress since 1889, and consists in removing snags and logs and closing secondary channels, or concentrating the flow at other critical points by dams of brush, logs, and stone.

The amount expended to June 30, 1902, was $5,500, as a result of which many of the worst places of the stream had been improved to the required extent.

There were no operations in progress during the past year, on account of the exhaustion of funds.

The average annual expenditure has been $500. Experience shows that this is too little to accomplish what is desired.

The traffic benefited by this improvement is a limited one, two small steamers being employed to carry passengers (almost exclusively summer tourists) and a small quantity of freight, which is principally fruit.

Entrances and clearances.

Calendar year.	Vessels entered.		Vessels cleared.	
	Number.	Tonnage.	Number.	Tonnage.
1890	948	131,607	946	131,395
1891	742	215,334	743	215,591
1892	1,726	707,285	1,727	707,785
1893	1,576	1,125,063	1,575	1,125,938
1894	1,100	900,000	1,100	900,000
1895	779	327,384	727	327,837
1896	835	439,031	833	435,033
1897	842	385,915	849	348,040
1898	948	1,216,567	943	1,114,560
1899	853	446,178	851	430,411
1900	940	453,543	934	442,419
1901	835	389,679	837	396,100

July 1, 1901, balance unexpended		$309,788.32
Amount collected account damage to pier, deposited January 29, 1902	$476.20	
Deposited February 17, 1902, account disallowance	3.75	
		479.95
Amount appropriated by river and harbor act approved June 13, 1902		24,000.00
		334,268.27
June 30, 1902, amount expended during fiscal year		[a] 97,020.22
July 1, 1902, balance unexpended		237,248.05
July 1, 1902, outstanding liabilities		518.00
July 1, 1902, balance available		236,730.05
July 1, 1902, amount covered by uncompleted contracts		192,650.00

(See Appendix M M 2.)

[a] Includes $700 for expenses of Office of the Chief of Engineers.

3. South Haven Harbor, Michigan.—This harbor is situated at the mouth of Black River. Improvements were begun in 1867, at which time there existed a channel 7 feet deep and 85 feet wide between slab piers. These piers had been built by residents of the vicinity at a cost of about $18,000. The banks of the river for 500 feet on each side had a rough protection of close piling.

The existing project is that of 1866 as modified in 1869, 1872, and 1888, and provides for constructing parallel piers and revetments 175 feet apart at the mouth of Black River, with the object of procuring a channel 12 feet deep, and to extend the navigable channel one-half mile up Black River to the highway bridge by dredging.

The total expenditure to June 30, 1902, was $299,965.59, of which $112,732.76 had been applied to maintenance by dredging and repair of existing structures. During the past year the harbor has been twice dredged. Deterioration is rapid on account of the insufficient length of the piers. At the conclusion of the dredging operations upon May 31, 1902, the available depths at mean low water were 16 feet outside of and at the ends of the piers and 14 feet between the piers, and 13.4 feet in the river, the latter being therefore the maximum draft which can be carried through to the wharves.

As is the case with most of the harbors in this vicinity, the principal traffic of South Haven depends upon the fruit crops and the summer-resort and excursion travel from Chicago. The business of the harbor has, however, been increasing rapidly for the last two years, and lately, in addition to the usual Chicago service, a service to Milwaukee, in connection with the Michigan Central Railroad, has been started. The steamers now in use do not exceed 12 feet in draft, but the demand is for larger vessels, and to permit their use the piers should be extended.

The Annual Report of the Chief of Engineers for 1897, pages 2948 and 2949, contains in full a report upon a proposed revised project. This report with its map is also published in House Doc. No. 279, Fifty-fourth Congress, second session.

Entrances and clearances.

Calendar year.	Number.	Tonnage.	Calendar year.	Number.	Tonnage.
1889 (estimated)	1,080		1896	1,218	343,016
1890	2,246	128,880	1897	1,256	351,000
1891	2,994	201,380	1898	771	322,620
1892	3,060	212,160	1899	682	276,117
1893	3,822	251,730	1900	1,231	407,289
1894	3,246	228,246	1901	1,177	546,756
1895	3,222	238,060			

July 1, 1901, balance unexpended	$2,136.70
Allotted from emergency act of June 6, 1900	2,300.00
Amount appropriated by river and harbor act approved June 13, 1902	12,000.00
	16,436.70
June 30, 1902, amount expended during fiscal year	4,102.29
July 1, 1902, balance unexpended	12,334.41

(See Appendix M M 3.)

4. Saugatuck Harbor and Kalamazoo River, Michigan.—These were formerly carried as separate works, but are now consolidated in con-

sequence of the provisions of the river and harbor act of June 13, 1902.

Before the work of improvement was begun by the United States, in 1869, this harbor, which is at the mouth of the Kalamazoo River, had been improved by local enterprise by the construction of slab piers 200 feet apart, the north pier being 500 feet long and the south pier 1,575 feet. The channel depth varied from 5 to 7 feet. The present project was adopted in 1867 and amended in 1869, 1875, and 1882. To June 30, 1902, $181,997.49 had been expended, of which $91,707.01 was for maintenance by dredging and pier repairs. At present there is a north pier 715 feet long, which is entirely unserviceable; separated from the pier by a long stretch of unprotected bank there is a north revetment, partly destroyed and partly covered by sand. The south pier is 3,863 feet long and is practically ruined. Frequent dredging has been required for maintenance of an 8-foot channel, which rapidly deteriorates. Appropriations since 1882 have been too small to keep the piers in proper repair.

The portion of the river which it is proposed to improve extends from the mouth to Saugatuck, a distance of a little over 3 miles. No work has yet been done.

The existing project was adopted by the river and harbor act of June 3, 1896. It provides for creating a channel of 12 feet depth and navigable width by dredging the river for a distance of 1¾ miles below Saugatuck, and thence making a new cut from the river to the lake, entering the latter about 3,700 feet above the present mouth at the Saugatuck piers. The original estimate for the work was $150,000, but authority was granted on May 31, 1900, to increase this to $250,000.

The only work done during the past year was dredging for the purpose of opening an 8-foot channel at Saugatuck Harbor. As has been the case in the past, this channel has again deteriorated and it is now impossible to carry more than 6 feet through to the wharves.

The harbor is near a very prosperous fruit region and the fruit traffic has been its principal source of business. Saugatuck is but 8 miles south of Holland, with which it is now connected by a trolley road, and about 17 miles north of South Haven. Holland and South Haven both command other sources of business than the fruit traffic alone, and bid fair to increase in importance through the fact that they are termini of important railroad lines.

The Annual Report of the Chief of Engineers for 1896, pages 2741–2743 and House Doc. No. 192, Fifty-fourth Congress, first session, contain in full the report pertaining to the adopted project for the proposed change in the location of this harbor. The House document contains also a map of the locality.

Entrances and clearances.

Calendar year.	Number.	Tonnage.	Calendar year.	Number.	Tonnage.
1888	262	132,400	1895	1,256	134,948
1889	314	76,300	1896	848	153,190
1890	178	42,000	1897	586	70,360
1891	492	120,000	1898	1,329	128,325
1892	(a)	(a)	1899	1,190	88,236
1893	626	162,632	1900	1,859	120,946
1894	862	106,000	1901	(a)	(a)

a Not stated.

July 1, 1901, balance unexpended	$20,092.61
Amount appropriated by river and harbor act approved June 13, 1902	15,000.00
	35,092.61
June 30, 1902, amount expended during fiscal year	5,151.10
July 1, 1902, balance unexpended	29,941.51
July 1, 1902, outstanding liabilities	32.47
July 1, 1902, balance available	29,909.04
Amount (estimated) required for completion of existing project	235,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	50,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix M M 4.)

5. Holland (Black Lake) Harbor, Michigan.—When improvement was begun in August, 1867, by the United States, there existed a narrow channel 5½ feet deep between piers built of brush and of irregular cribs. These had been constructed by the harbor commissioners of the adjoining town of Holland.

The present project was adopted in 1867 and amended in 1873, 1879, 1884, and 1892. From 1867 to 1880 there were built by the United States piers and revetments aggregating 1,854 feet on the north side and 1,531 feet on the south side. Since the latter date there have been no additions to these structures, which were designed to create a 12-foot channel varying in width from 160 feet inside to 213 feet outside, except in 1889 a length of 160 feet of pile pier on the south side, designed to close a gap in the existing structure. Upon this project there was expended up to March 3, 1899, $304,217.30, of which $127,597.50 was for maintenance. Repairs made during recent years have diminished the width inside to 148 feet.

The revised project at present in force was adopted in the river and harbor act of March 3, 1899, and provides for securing a channel 16 feet deep, protected by piers and revetments 148 feet to 250 feet apart, the estimated cost of completion being $240,000. From March 3, 1899, the date of adoption of the present project, to June 30, 1902, there was expended $38,743.96, of which $4,286.86 was for maintenance by dredging.

The natural depth remains from 7 to 8 feet, so that repeated dredging is necessary to secure temporarily a depth of 13 feet. No work was done during the past year except a slight amount of dredging, by means of which a channel whose ruling minimum depth at mean low water is 14 feet had been restored.

This harbor is relatively an important one, being the terminus of one of the lines of the Pere Marquette Railroad Company, which here connects with two lines of steamers, which during the season of navigation and when the condition of the harbor permits run regularly to Chicago and Milwaukee. The passenger business is especially important, but there is also a profitable freight traffic, especially during the fruit season. The harbor justifies early improvement in accordance with the requirements of the revised project.

The report upon which the present revised project is based is published in full in the Annual Report of the Chief of Engineers for 1897, pages 2950, 2951.

Entrances and clearances.

Calendar year.	Number.	Tonnage.	Calendar year.	Number.	Tonnage.
1889	1,087	80,790	1896	408	269,182
1890	(a)	(a)	1897	456	153,852
1891	2,676	178,300	1898	538	163,119
1892	2,800	200,000	1899	527	(a)
1893	2,060	315,150	1900	862	354,718
1894	1,816	159,657	1901	878	600,584
1895	809	210,299			

a Not stated.

July 1, 1901, balance unexpended	$726.47
Allotted from emergency act of June 6, 1900	3,200.00
Amount appropriated by river and harbor act approved June 13, 1902	73,000.00
	76,926.47
June 30, 1902, amount expended during fiscal year	573.61
July 1, 1902, balance unexpended	76,352.86
July 1, 1902, outstanding liabilities	80.00
July 1, 1902, balance available	76,272.86
July 1, 1902, amount covered by uncompleted contracts	3,200.00

(See Appendix M M 5.)

6. Grand Haven Harbor, Michigan.—This harbor is at the mouth of Grand River, the largest river in the State of Michigan. Before any work had been done the natural depth at the mouth of the river varied from 9 to 12 feet, with greater depths in the inner reaches.

In 1857 the Detroit and Milwaukee Railroad Company (Grand Trunk), whose western terminus is at the town of Grand Haven, built a pile pier 3,185 feet long upon the south side of the entrance, and also revetted, by means of close piles, portions of the bank upon the north side of the river. In 1866, when work by the United States was begun, the pile pier had been partly destroyed by fire and by storms. The available depth was 13 feet.

The present project was adopted in 1866, amended in 1868, 1880, 1890, and 1892. It provides for the construction of parallel piers and revetments 400 feet apart, with the object of creating an entrance channel 18 feet deep. Estimated cost was $804,366.15. The amendments to the original project did not materially change its original purpose, the changes being principally in the proposed length of the piers and revetments.

To June 30, 1902, there has been expended upon the existing project the sum of $756,779.61, of which $213,802.79 was applied to maintenance, consisting chiefly in repairs to existing structures.

The result of the above expenditure was the construction and maintenance of 3,538 linear feet of north pier and 5,774 linear feet of south pier, with a channel of variable depth between them maintained by occasional dredging. At present the entrance is obstructed by a central shoal, whose crest is at a distance of from 500 to 800 feet beyond the entrance, upon which the minimum available depth is 16.3 feet. The channel to the north of the shoal affords a minimum available depth of 20 feet and that to the south of 17.1 feet. Between the piers the minimum available depth is 19 feet, and farther inside the available depth is 20 feet and more.

The central outer bar above referred to serves seriously to impair what would otherwise be an excellent harbor. Its periodical removal should be provided for. Pier extension alone is powerless to accomplish this end.

This harbor has for years been one of considerable importance. It is the western terminus of the Detroit, Grand Haven and Milwaukee Branch of the Grand Trunk Railroad, in connection with which is run throughout the year a line of steamers to Milwaukee. In addition there are two lines with regular and frequent scheduled trips to Chicago. All three lines do a large passenger and a very considerable freight business, especially during the season of fair weather.

The latest map of this harbor is found in the Annual Report of the Chief of Engineers for 1890, page 2650.

Entrances and clearances.

Calendar year.	Number.	Tonnage.	Calendar year.	Number.	Tonnage.
1888	1,508	1,405,600	1895	574	482,822
1889	1,110	649,370	1896	883	727,209
1890	1,172	834,089	1897	1,151	1,018,805
1891	819	616,422	1898	934	874,312
1892	815	693,835	1899	1,250	1,090,325
1893	761	613,425	1900	1,151	1,132,881
1894	641	504,609	1901	759	706,627

July 1, 1901, balance unexpended	$17,029.86
Deposited February 17, 1902, account disallowance	6.17
Amount appropriated by river and harbor act approved June 13, 1902	10,000.00
	27,036.03
June 30, 1902, amount expended during fiscal year	4,443.32
July 1, 1902, balance unexpended	22,592.71
July 1, 1902, outstanding liabilities	365.00
July 1, 1902, balance available	22,227.71

(See Appendix M M 6.)

7. Grand River, Michigan.—Before any work of improvement was done upon this stream the depth in the crossings over some of the bars did not exceed 2 feet.

Between 1881 and 1886 the sum of $50,000 was expended in securing, by dredging, narrow channels through these bars, with a depth of about 4 feet. No further work was done until 1896, but even then, at the expiration of over ten years, traces of the dredged cuts were still apparent.

The present project, upon which work was begun in May, 1897, was adopted by the river and harbor act of June 3, 1896, and is based upon a report upon examination and survey reprinted in report of the Chief of Engineers for 1892, pages 2369 to 2395. The project contemplates dredging a channel a distance of 38 miles, from Grand Haven to Grand Rapids, with a depth of 10 feet and a width of 100 feet. The project also proposes the use of contraction works wherever necessary to increase the effect of the dredging or to render it more permanent.

Estimated cost was $670,500. Up to June 30, 1902, $121,965.99 had been expended upon this project in dredging 383,291.35 cubic yards of material and in building 94,983 feet of longitudinal training walls. The maximum available depths at extreme low water over the

shoalest crossings varied from 2.9 to 5 feet, and there were but ten crossings with depth less than 4 feet. The project from its nature is one of constant repair and maintenance. High water ordinarily occurs in the early spring and is from 12 to 18 feet above low water in the neighborhood of Grand Rapids. In the lower part of the river the difference between the high and low stages becomes less, and at the mouth is inconsiderable. The commerce involved is purely prospective and it is probable that but little benefit will be derived from the improvement until it is practically completed.

Entrances and clearances.

Calendar year.	Number.	Tonnage.	Calendar year.	Number.	Tonnage.
1896	282	46,750	1899	323	64,242
1897	77	30,390	1900	264	59,928
1898	76	86,793	1901	178	84,506

July 1, 1901, balance unexpended	$13,336.19
Amount appropriated by river and harbor act approved June 13, 1902	150,000.00
	163,336.19
June 30, 1902, amount expended during fiscal year	10,302.18
July 1, 1902, balance unexpended	153,034.01
July 1, 1902, outstanding liabilities	860.00
July 1, 1902, balance available	152,174.01

(See Appendix M M 7.)

8. Muskegon Harbor, Michigan.—This harbor is the outlet of Muskegon River, one of the largest in Michigan, which before emptying into Lake Michigan expands into Muskegon Lake. The channel between the lakes in 1867, before operations were begun by the United States, was 3,000 feet long and about 12 feet deep, except at the entrance, where the depth was 11 feet, and the channel fluctuating. By private enterprise the entrance had been protected by converging slab piers.

The present project was adopted in 1866, and amended in 1869, 1873, 1881, 1884, 1890, 1892, and 1902. In its final form it provides for a through channel 20 feet deep and 300 feet wide, protected by piers and revetments. Estimated cost of completion of revised project of 1902, $380,000. The various changes in the original project did not modify it essentially. They refer merely to the depth of the channel and to the width, length, and direction of the piers.

To June 30, 1902, there was expended upon former modifications of project the sum of $526,293.36, of which $138,074.94 was for maintenance by repairs and dredging. During the past year the superstructure of the 200-foot extension of the north pier was completed, and the south pier was extended by a single crib 100 feet long and 30 feet wide, the superstructure of which was completed early in December. As a result of the above expenditure, therefore, there have been constructed a north pier and revetment 2,780 feet long, and a south pier and revetment 2,090 feet long, protecting a channel whose width varies from 308 feet at the entrance to 167 feet inside, while the maximum depth which can be carried over the shoalest point in the channel is at mean low water 17 feet. To procure and maintain this depth during the past fiscal year the channel was dredged in August, 1901, and dredging operations are again in progress at this time. The last

modification of the existing project was adopted by the river and harbor act of June 13, 1902, and as yet no work has been done upon it.

During the season of navigation three lines of steamers regularly use this harbor, which is a terminus of three important railroad lines. Their business is a substantial one and with increased facilities should grow considerably. A general freight and passenger business is done and in the summer months is largely augmented by the fruit and the resort traffic. Muskegon Lake itself is a magnificent harbor, 5 miles long and about 1½ miles wide, with depths varying from 30 to 40 feet. If readily accessible this would be an excellent harbor of refuge.

The Annual Report of the Chief of Engineers for 1901, pages 3131–3134, and House Doc. No. 104, Fifty-sixth Congress, second session, contain in full a report upon a preliminary examination of this harbor, in which it is estimated that to secure a channel 300 feet wide and 20 feet deep will cost $380,000, and such a project is recommended for approval. A map showing the harbor and the outlines of the above project accompanies the executive document mentioned. This is the basis of the present approved project.

Entrances and clearances.

Calendar year.	Number.	Tonnage.	Calendar year.	Number.	Tonnage.
1888	2,683		1895	887	441,289
1889	4,626	884,869	1896	981	562,757
1890	3,786	649,540	1897	1,244	725,514
1891	2,886	704,046	1898	1,503	1,165,802
1892	4,174	740,021	1899	1,545	1,234,198
1893	2,482	834,049	1900	1,366	904,636
1894	1,423	793,184	1901	1,681	1,154,924

July 1, 1901, balance unexpended	$32,731.46
Allotted from emergency act of June 6, 1900	3,000.00
Amount appropriated by river and harbor act approved June 13, 1902	75,000.00
	110,731.46
June 30, 1902, amount expended during fiscal year	32,524.82
July 1, 1902, balance unexpended	78,206.64
July 1, 1902, amount covered by uncompleted contracts	3,000.00

(See Appendix M M 8.)

9. Pentwater and White Lake harbors, Michigan.—These harbors were formerly carried as separate works, but are now consolidated in consequence of a provision in the river and harbor act of June 13, 1902.

(*a*) *White Lake Harbor.*—When the present project was adopted the natural outlet of White Lake, about 3,550 feet north of the present entrance, afforded a channel 5 feet deep and 125 feet wide between slab piers built by local enterprise.

The approved project provided for the abandonment of the old outlet and the creation of a new one, 12 feet deep and 200 feet wide between piers and revetments. This project was adopted in 1866, amended in 1873, 1884, and 1892, the present amended estimated cost being $353,550. The various amendments to the original project have not altered it materially, as they relate principally to the length of the proposed piers and revetments. The existing project, therefore, provides for the creation and maintenance of a channel 12 feet deep between piers and revetments about 184 feet apart.

To June 30, 1902, there was expended upon the existing project the sum of $324,418.39, of which $116,555.95 was for maintenance by dredging and repairs. This expenditure procured the construction and maintenance of a north pier and revetment 1,715 feet long and a south pier and revetment 1,953 feet long, the natural depth of the channel between them being about 10 feet. Periodical dredging is necessary to secure and maintain a 12-foot channel. Up to June 30, 1902, the maximum draft that could be carried over the shoalest point in the channel was 11.9 feet. No work was done at this locality during the past year, the amount expended being for contingencies.

The harbor is but 10.5 miles north of Muskegon. Such traffic as there is hardly exceeds in value the annual expenditure necessary to maintain a reliable 12-foot channel.

The last published map of the locality is contained in the Annual Report of the Chief of Engineers for 1884, page 1982.

(*b*) *Pentwater Harbor.*—Before work was begun at this harbor by the United States there existed an irregular channel 4 feet deep and 75 feet wide between slab piers built by local enterprise.

The existing project, adopted in 1867 and amended in 1873, 1884, and 1892, provides for widening the old entrance to 150 feet and to deepen it to 12 feet, the sides being protected by piers and revetments. Estimated cost was $327,713.40. The amendments to the original project relate merely to the length of the proposed piers and revetments and in no wise enlarge its original scope. The present project, therefore, provides for a channel 12 feet deep and about 150 feet wide, protected by suitable piers and revetments.

To June 30, 1902, there was expended the sum of $272,917.55, of which $93,044.40 was for maintenance by repair and dredging. The result was a channel 140 to 153 feet wide, whose natural depth is from 9 to 10 feet, protected by a north pier and revetment 2,226 feet long, and a south pier and revetment 1,847 feet long. Periodical dredging is necessary to secure the projected depth of 12 feet. No work was done during the past year, the amount expended being for contingencies. The maximum depth which, upon June 30, 1902, could be carried over the shoalest point in the improved channel was at low water 11.6 feet.

This harbor has not during the past year been served by any regular lines and its commercial importance, never great, has for some years past steadily diminished. The excellent and very important harbor of Ludington is 12 miles north of Pentwater.

The last published map of this locality is found in the Annual Report of the Chief of Engineers for 1884, page 1980.

Entrances and clearances.

WHITE LAKE.

Calendar year.	Number.	Tonnage.	Calendar year.	Number.	Tonnage.
1888	1,408	147,142	1895	281	34,574
1889	732		1896	245	27,962
1890	579	62,276	1897	247	33,409
1891	405	47,135	1898	175	16,415
1892	392	58,950	1899	(a)	(a)
1893	260	1,052,026	1900	(a)	(a)
1894	195	18,115	1901	(a)	(a)

a No data could be obtained.

Entrances and clearances—Continued.

PENTWATER.

Calendar year.	Number.	Tonnage.	Calendar year.	Number.	Tonnage.
1888	300	45,000	1895	500	
1889	(a)	(a)	1896	(a)	(a)
1890	27	2,559	1897	(a)	(a)
1891	1,140	71,260	1898	1,208	108,253
1892	(a)	(a)	1899	(a)	(a)
1893	116		1900	(a)	31,721
1894	60		1901	180	(a)

a Not stated.

July 1, 1901, balance unexpended	$1,965.89
Amount appropriated by river and harbor act approved June 13, 1902	35,000.00
	36,965.89
June 30, 1902, amount expended during fiscal year	931.83
July 1, 1902, balance unexpended	36,034.06
July 1, 1902, outstanding liabilities	98.89
July 1, 1902, balance available	35,935.17

(See Appendix M M 9.)

10. Ludington Harbor, Michigan.—This harbor is the outlet of Pere Marquette River, which expands into Pere Marquette Lake before emptying into Lake Michigan. In 1867, before improvement was begun by the United States, the outlet from Pere Marquette Lake to Lake Michigan had a length of 830 feet protected by divergent slab piers. The entering depth was 7 to 8 feet.

The present project was adopted in 1867 and modified in 1885, 1889, 1890, and 1899. In its final form, as adopted by the river and harbor act of March 3, 1899, it provides for a through channel 183 to 285 feet wide and 18 feet deep, protected by the requisite piers and revetments. Estimated amount required to complete revised project was $210,000. It can not be said that the modifications of the original project materially changed it in any regard. The development of the harbor has been progressive, the changes in the original project affecting only the length of the piers and their direction, and the depth between them. It may therefore be said that the estimated cost of completion of the present project is really the sum of the above amount and that previously expended, or $591,055.91 in all.

To June 30, 1902, the sum of $410,231.10 was expended upon the original project and its subsequent modifications. Of the above sum $98,806.68 was for maintenance by repairs and dredging, of which $14,850.12 was expended upon the repair of 444 linear feet of the north pier and 303 linear feet of the south pier, this work being a portion of that included in the modified project of 1899. No other work has been done upon the completion of this project.

As a result of the above expenditure, there now exists a reasonably reliable 18-foot channel protected by piers and revetments 1,452 feet long on the north and 2,381 feet long on the south side. Occasional dredging is necessary to give the 18-foot channel sufficient width. During the past year the only work done was the completion of a contract for dredging, work upon which was in progress at the close of the fiscal year 1901. On June 30, 1902, the maximum draft

that could be carried over the shoalest point in the channel was 18.5 feet.

This harbor is one terminus of the main line of the Pere Marquette Railroad Company, which operates lines of car ferries from this point to Manitowoc, Wis., and Milwaukee, Wis. A line of passenger and package freight steamers owned by the railroad company also makes regular sailings to Milwaukee. The business done by the car-ferry lines is of enormous and constantly increasing importance in its effect upon freight rates to and from the northwest. The volume of this business has steadily increased, and the only limit to its possibilities is fixed by the condition of this harbor. It is desirable to give to the car-ferry service the same assurance of regularity of schedule as exists in the case of the ordinary railroad lines. At present difficulty is usually experienced in the fall and winter months, due to the narrowing of the channel by a shoal from the north. The car ferries are large and unwieldy and require ample sea room. A narrow channel is therefore impracticable, and to assure safety and regularity to the service dredging should be done as late in the fall as is possible with the type of dredge available. With a first-class seagoing hydraulic dredge available, there would be practically no time when dredging could not be done.

The Annual Report of the Chief of Engineers for 1897, pages 2951–2953, contains in full the existing approved project, adopted by the river and harbor act of March 3, 1899. This is based upon a report which, with a map, is published in House Doc. No. 273, Fifty-fourth Congress, second session.

Entrances and clearances.

Calendar year.	Number.	Tonnage.	Calendar year.	Number.	Tonnage.
1888	1,778	277,074	1895	1,556	594,124
1889	1,759		1896	1,996	952,469
1890	2,270	461,997	1897	2,063	2,944,425
1891	2,420	610,057	1898	2,493	2,014,019
1892	1,969	538,568	1899	2,587	2,254,495
1893	979	211,438	1900	2,637	2,526,244
1894	1,466	426,599	1901	3,188	3,413,041

July 1, 1901, balance unexpended	$7,377.29
Amount appropriated by river and harbor act approved June 13, 1902	75,000.00
	82,377.29
June 30, 1902, amount expended during fiscal year	4,174.29
July 1, 1902, balance unexpended	78,203.00
July 1, 1902, outstanding liabilities	4.60
July 1, 1902, balance available	78,198.40
Amount (estimated) required for completion of existing project	165,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	165,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix M M 10.)

11. Manistee Harbor, Michigan.—In 1866, previous to the beginning of work by the United States, the entrance to this harbor was

improved by slab piers 100 feet to 150 feet apart, built by local enterprise, a navigable depth of 7 to 8 feet being thereby maintained.

The present project was adopted in 1867 and amended in 1871, 1873, 1875, 1884, 1890, and 1892, and provides for a channel of navigable width with a depth of 15 feet, extending from Lake Michigan to Manistee Lake, protected by piers and revetments at the entrance. The various modifications of the original project merely extended its limits, changed the proposed length of the piers and the proposed depth from 12 feet to 15 feet. Operations have been progressive, and no work under any of the projects not essential to the project in its final form has been done.

Up to June 30, 1902, there had been expended $391,655.87, of which $86,427.66 was for maintenance by dredging and repairs. Of this latter amount $5,831.57 was expended during the past fiscal year in rebuilding 253.8 linear feet of superstructure on north pier and 101.5 linear feet on south pier.

As a result of the above total expenditure to June 30, 1902, there had been built 2,906 linear feet of north and 1,300 linear feet of south pier and revetment, the width between the piers varying between 150 feet inside and 190 feet at the outer end of the south pier, which is 400 feet shorter than the north pier. The through channel had at various times been dredged so as to afford the projected depth of 15 feet. This channel, however, requires periodical dredging. The maximum draft which upon June 30, 1902, could be carried through the improved channel was 15 feet.

The commerce tributary to this harbor is derived principally from the salt and the lumber industries. With the exhaustion of the supply of standing timber, the latter industry is steadily diminishing. The harbor is a regular port of call for one line of steamers plying from Chicago to points upon the east shore of Lake Michigan, and a single steamer also makes stated trips from Manistee to Milwaukee.

The last published map of this locality is found in Annual Report of the Chief of Engineers for 1890, opposite page 2618.

Entrances and clearances.

Calendar year	Number.	Tonnage.	Calendar year.	Number.	Tonnage.
1888	3,595	966,221	1895	3,054	930,645
1889	3,624	945,329	1896	2,355	643,048
1890	3,691	975,049	1897	2,371	666,000
1891	3,617	1,079,818	1898	1,856	528,752
1892	4,044	1,028,629	1899	2,313	693,662
1893	2,831	959,550	1900	2,049	625,630
1894	3,064	956,463	1901	2,276	671,219

July 1, 1901, balance unexpended	$9,175.70
Amount appropriated by river and harbor act approved June 13, 1902	42,000.00
	51,175.70
June 30, 1902, amount expended during fiscal year	5,831.57
July 1, 1902, balance unexpended	45,344.13

(See Appendix M M 11.)

12. Harbor of refuge at Portage Lake, Manistee County, Mich.—In 1879, when work was begun by the United States, there was a channel 4 feet deep and 130 feet wide between slab piers built by local enterprise.

The approved project, adopted in 1879 and amended in 1881 and 1890, contemplates the construction of a harbor of refuge, with an entrance from Lake Michigan 356 feet wide and 18 feet deep, protected by piers and revetments. Estimated cost, revised in 1897 and 1899, was $344,300.

The modifications of the original project have in no way changed its scope, so that essentially the project is to-day as when originally adopted. All expenditures made up to the present time have contributed to the completion of the project in its present form.

To June 30, 1902, $310,035.04 was expended, of which $92,727.42 was for maintenance by repair and dredging. Of the above total expenditure, $154,107.11 was expended upon the completion of 16 cribs, 7 in the north and 9 in the south pier, thereby extending these piers respectively 700 and 900 feet. Six of these cribs were placed during the past fiscal year. The approved project is now completed, with the exception of the dredging necessary to provide the 18-foot channel.

On June 30 the maximum draft that could be carried through from Lake Michigan to Portage Lake was 12 feet.

Until the projected dredging has been completed, this harbor will not be available for the purpose for which it has been designed. There is absolutely no local commerce. When the harbor of refuge is completed, its existence will serve to permit vessels engaged in the general lake commerce, if necessary, to approach more closely the east shore of Lake Michigan, which in this vicinity has hitherto been destitute of harbors readily available in foul weather.

The last published map of this locality is found in the Annual Report of the Chief of Engineers for 1884, page 1974.

July 1, 1901, balance unexpended	$101,993.24
Amount appropriated by river and harbor act approved June 13, 1902	59,000.00
	160,993.24
June 30, 1902, amount expended during fiscal year	101,528.28
July 1, 1902, balance unexpended	59,464.96

(See Appendix M M 12.)

13. Frankfort Harbor, Michigan.—In 1867, when the United States began work of improvement at this harbor, which is the outlet to Lake Aux Becs Scies, there existed an outlet about 750 feet north of the present channel, affording a depth of 3 to 4 feet and width of 70 to 80 feet between slab piers built by local enterprise.

The present project was adopted in 1866, and as amended in 1868, 1879, and 1892 provided for a new outlet, with channel 12 feet deep and 200 feet wide, protected by piers and revetments. The estimated cost, revised in 1897 in compliance with the river and harbor act of June 3, 1896, to cover the cost of securing channel 18 feet deep, was $413,659.85, further revised in 1899 to $421,938.35. The changes in the original project have been in effect merely extensions, so that the existing project does not differ in kind from the original one. All expenditures may therefore justly be regarded as pertaining to the present project.

To June 30, 1902, $376,528.41 was expended upon this harbor, of which $85,321.42 was for maintenance by repairs and dredging, $1,938.67 of this latter sum having been expended in dredging during the past fiscal year. No other work was done. The total expenditure

above mentioned has resulted in the creation and maintenance of a channel 18 feet deep, whose natural depth is 12 feet, the width being 200 feet. It is protected by a north pier and revetment 1,499 feet long and a south pier and revetment 1,938 feet long, of which the outer 400 feet was built by the Toledo and Ann Arbor Railroad Company. Annual dredging is required to maintain the depth needed for navigation.

On June 30, 1902, the maximum draft that could be carried through the improved channel was 18 feet.

Practically the entire commerce of this harbor is transacted by the car-ferry lines of the Ann Arbor Railroad, which has its northern terminus at this harbor. These car ferries run to Kewaunee and Marinette, Wis., upon the west shore of Lake Michigan, and form a highly important link in the through commerce between the Northwest and the Atlantic seaboard. The importance of maintaining adequate facilities at Frankfort Harbor is manifest. This can be done with certainty only by repeated, radical dredging. Pier extension unaccompanied by thorough dredging will not serve.

The last published map of this harbor is found in the Annual Report of the Chief of Engineers for 1884, page 1973.

Entrances and clearances.

Calendar year.	Number.	Tonnage.	Calendar year.	Number.	Tonnage.
1888	1,342	216,376	1895	1,182	412,951
1889	(a)	(a)	1896	1,374	509,277
1890	443	57,140	1897	1,714	706,546
1891	1,541	258,908	1898	1,681	793,896
1892	910	167,777	1899	1,790	1,405,955
1893	988	278,709	1900	1,480	1,308,722
1894	1,101	337,728	1901	1,757	2,470,722

a Not stated.

July 1, 1901, balance unexpended	$3,348.61
Amount appropriated by river and harbor act approved June 13, 1902	54,500.00
	57,848.61
June 30, 1902, amount expended during fiscal year	1,938.67
July 1, 1902, balance unexpended	55,909.94

(See Appendix M M 13.)

14. Charlevoix Harbor and entrance to Pine Lake, Michigan.—In 1868, when the first estimate for improvement was made, the available channel in Pine River between Lake Michigan and Round Lake was 75 feet wide and 2 to 6 feet deep. Up to 1873 the local authorities, with some assistance from the State, had constructed 468 feet of crib work in the north pier and 80 feet of crib work in the south pier, and the available depth was 6 feet. The first appropriation by the United States was made in 1876, and actual operations were begun in fiscal year 1878 upon the lower channel; the first appropriation for the upper channel was made in 1882, and actual work begun in 1885. Total estimated cost was $186,000.

The present project was proposed in 1868, and, as amended in 1876 and 1882, provides for a 12-foot channel from Lake Michigan to Round Lake between piers and revetments 100 to 150 feet apart, and from Round Lake to Pine Lake between revetments 83 feet apart.

The amendments to the original project served to extend its limits, but did not materially alter its scope, so that all expenditures made to the present time may be regarded as relating to the project in its latest revised form.

Up to June 30, 1902, the sum of $154,368.81 was expended upon the existing project and its various modifications. The result was a channel whose natural depth is 10 feet, protected in its two divisions by a north pier and revetment 2,064 feet long and a south pier and revetment 2,396 feet long. Of the above total expenditure $74,163.77 was for maintenance by repair and dredging. The only work done during the past fiscal year was dredging under contract in the lower channel for the purpose of removing obstructing shoals. The cost of this work was $3,256.23, which is included in the above statement of the cost of maintenance, which includes all expenditures of any kind made since 1890, since which date no new work has been done.

The maximum draft which, on June 30, 1902, could be carried through the improved lower channel was 16.3 feet and through the upper channel 15 feet.

The principal traffic tributary to this harbor is furnished by the lumber industry, which has recently been growing greatly in importance. The principal sawmills are situated at Boyne City and East Jordan, both at the upper end of Pine Lake, the outlet for which is the upper channel. Due to the fact that many of the lumber-carrying vessels do not clear at Charlevoix, the commercial statistics fail to disclose the full traffic, which is, however, known to be considerably over 1,000,000 tons. Charlevoix is also a much frequented summer resort and during the summer season two steamboat lines make regular and frequent calls at this harbor. There is in addition a small amount of local traffic. The 12-foot channel called for by the existing project is not sufficient for the needs of the lumber trade. The depth should be increased to 16 feet to enable the larger class of vessels to transact their business with economy.

The report upon a survey made with a view to obtaining a 16-foot channel is published in full in the Annual Report of the Chief of Engineers for 1897, pages 2953–2954, and is also printed with a map in House Doc. No. 144, Fifty-fourth Congress, second session.

Entrances and clearances.

Calendar year.	Number.	Tonnage.	Calendar year.	Number.	Tonnage.
1888	526	92,306	1895	528	92,387
1889	473		1896	420	75,263
1890	532	75,224	1897	545	110,474
1891	534	79,613	1898	566	106,797
1892	537	79,966	1899	675	144,400
1893	820	144,976	1900	1,725	350,769
1894	1,701	338,015	1901	978	217,776

July 1, 1901, balance unexpended	$4,387.42
Amount appropriated by river and harbor act approved June 13, 1902	20,000.00
	24,387.42
June 30, 1902, amount expended during fiscal year	3,256.23
July 1, 1902, balance unexpended	21,131.19

(See Appendix M M 14.)

15. Petoskey Harbor, Michigan.—Before work at this harbor was begun by the United States its landing pier was exposed to winds coming from between west and northwest, and in high gales it was dangerous to attempt a landing.

The present project was adopted in the river and harbor act of August 18, 1894. The approved project provides for constructing a breakwater 600 feet long about 600 feet west of the outer end of the landing pier, and another north of it 500 feet long, or as much longer as may be found necessary to cover the landing from all dangerous seas. Work was begun in 1896. Estimated cost was $170,000.

To June 30, 1902, there had been expended upon this work $55,363.23, of which $2,206.58 was for maintenance. Four hundred feet of the west breakwater and 200 feet of the north breakwater had been built of timber cribs resting upon stone foundation in deep water and upon natural bottom in shallow water. The remaining 200 feet of the west breakwater had been constructed of riprap stone and bowlders of suitable size.

During the past fiscal year no work was done at this harbor. The amount expended during the year was used to pay expenses of the Office of the Chief of Engineers, and for contingencies.

The present north breakwater is unduly close to the outer end of the city wharf and the entrance between the two breakwaters is too contracted. Much complaint on this account has been made by the navigators using this harbor, and some remedy seems necessary. Relief may readily be afforded by removing to some new and better location the 200 feet of north breakwater already in place. Authority to make this change is contained in the river and harbor act of June 13, 1902.

The business of this harbor is principally due to the numerous summer resorts upon Little Traverse Bay. Four lines of large steamers use the harbor as a port of call, and there is also a large and prosperous local business.

Entrances and clearances.

Calendar year.	Number.	Tonnage.	Calendar year.	Number.	Tonnage.
1893	1,338	8,000	1898	4,704	76,000
1894	4,160	20,000	1899		
1895	4,360	28,000	1900		
1896	3,156	24,000	1901		
1897	4,362	91,600			

July 1, 1901, balance unexpended	$17,739.63
Amount appropriated by river and harbor act approved June 13, 1902	15,000.00
	32,739.63
June 30, 1902, amount expended during fiscal year	[a] 102.86
July 1, 1902, balance unexpended	32,636.77

(See Appendix M M 15.)

[a] Includes $100 for expenses of Office Chief of Engineers.

IMPROVEMENT OF RIVERS AND HARBORS ON THE EASTERN COAST OF MICHIGAN.

This district was in the charge of Maj. W. L. Fisk, Corps of Engineers, to November 7, 1901, and of Capt. Lansing H. Beach, Corps of Engineers, since that date. Division Engineer, Col. S. M. Mansfield, Corps of Engineers, to July 24, 1901, and Lieut. Col. O. H. Ernst, Corps of Engineers, since that date.

1. Cheboygan Harbor, Michigan.—The present harbor is the result of improvements made at the mouth of Cheboygan Harbor since 1871, when the available depth of water was only 6 feet. The project called for a channel 200 feet wide and 14 feet deep, to be secured largely by revetments and guiding walls, and the estimated cost of the whole work was $395,335. The project was modified in 1880 to increase the navigable depth to 15 feet, this channel to be obtained by dredging, and in 1896 to make it 18 feet, and such depth now exists from deep water in the Straits of Mackinac to a point about 2,700 feet below the upper limits of the harbor. The report of the Chief of Engineers for 1896, page 2723, summarizes the history of operations to that date.

The work done since was in 1899 and 1900, when 106,115 cubic yards of sand, clay, and mill refuse was removed, at a cost of 14.7 cents per cubic yard, scow measure, and the channel carried forward according to project to within 2,700 feet of the upper limits of the harbor, which distance still remains to be dredged.

The total length of improved channel from deep water in the Straits of Mackinac to the State Road Bridge is 7,900 feet; of this 5,900 feet is in the Straits of Mackinac.

The total amount expended to June 30, 1902, was $165,590.04.

COMMERCIAL STATISTICS.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1893	155,898	285,189	1898	366,332	334,636
1894	76,554	227,346	1899	152,689	352,214
1895	110,062	216,868	1900	44,237	59,536
1896	163,362	362,011	1901	161,771	252,727
1897	147,255	293,161			

July 1, 1901, balance unexpended	$2,436.14
Amount appropriated by river and harbor act approved June 13, 1902	8,000.00
	10,436.14
June 30, 1902, amount expended during fiscal year	26.18
July 1, 1902, balance unexpended	10,409.96

(See Appendix N N 1.)

2. Alpena Harbor (Thunder Bay River), Michigan.—The original depth at the entrance to Thunder Bay River, which forms the harbor of Alpena, was only 7 feet, but local enterprise had secured a narrow channel 12 feet deep through the bar before work was undertaken by the Government in 1877, when, under the appropriation of the preceding year, a channel 13 feet deep and 200 feet wide was secured in the bay. Shoaling having occurred, the channel was again dredged in

1883, this time to a depth of 14 feet. In 1889 the project was modified so as to propose a channel depth of 16 feet and the extension of the improvement up the river about a mile to the vicinity of the dam across the river at that point, with widths varying as follows: Two hundred feet at the 16-foot contour in Thunder Bay, thence tapering to 100 feet at the light-house crib, thence 100 feet to the Second street drawbridge, thence 75 feet to the Minor Lumber Company's wharf, thence 50 feet to the upstream limit of the channel improvement.

This project was completed in 1893, and under it a channel 2,250 feet long and 100 to 200 feet wide was secured in Thunder Bay, and a channel 4,300 feet in length provided in the river. The channel was redredged in 1899.

No work was necessary at this locality during the past year.

The total amount expended to June 30, 1902, was $49,174.07.

COMMERCIAL STATISTICS.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1893	51,600	308,988	1898	60,300	236,075
1894	102,700	363,291	1899	27,888	197,725
1895	35,957	269,203	1900	51,653	263,702
1896	94,067	255,687	1901	62,131	169,442
1897	78,378	293,161			

July 1, 1901, balance unexpended $2,325.93
July 1, 1902, balance unexpended 2,325.93

(See Appendix N N 2.)

3. Saginaw, Flint, Shiawassee, and Bad rivers, Michigan.—(*a*) *Saginaw River.*—Before improvement the navigable capacity of this stream was limited by the bar at its mouth, where a channel depth of only 8 feet was available, and by many shoal stretches in the river between there and the city of Saginaw, over which still less depth was to be found. Its improvement was commenced in 1867 by dredging a straight cut through the bar at the mouth to a depth of 13 feet. In subsequent years the scope of operations was gradually extended to various shoals higher up, but subject to no general project until 1882, when a comprehensive and connected scheme of improvement covering the entire river was adopted. It called for a navigable channel 14 feet deep and 200 feet wide from Saginaw Bay to the upper limits of Bay City, about 8 miles above the point of beginning, and thence to the head of navigation, some 16 miles farther up, a channel of the same width but only 12 feet deep. The estimated cost of this project was $446,000, which, added to the estimated cost of the several preceding projects ($294,378), gives $740,378 as the estimate of cost for the whole improvement. These estimates concerned the question of original cost only and took no note of maintenance, which, in a stream of this character, is a matter of great and constant expense, and in the absence of appropriations specifically applicable thereto must be an annual tax of no small magnitude on the successive appropriations for construction. The sum total of appropriations that will have to be made before the work can be completed must therefore largely exceed the original estimates for construction only.

The total expenditure to June 30, 1902, was $771,785.13, and the result has been to obtain only a narrow through channel, which has little permanence, and almost constant dredging is needed to maintain it. This has been the case especially as respects the section of river from Bay City to Saginaw and in a somewhat less degree through the bar at the river's mouth in Saginaw Bay. At present the maximum depth available over most shoal places above Bay City is somewhat less than 10 feet. In order to restore and maintain the channel as required in the interests of navigation the work of dredging should be constant until a depth of 14 feet and a minimum width of 150 or 200 feet is obtained.

COMMERCIAL STATISTICS.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1893	651,163	1,069,298	1898	1,126,891	364,561
1894		1,108,307	1899	728,629	311,547
1895	391,751	347,146	1900	482,253	402,827
1896	471,106	240,496	1901	1,250,292	694,741
1897	995,960	354,860			

New line of transportation established: The steamer *New Baltimore*, running between Saginaw and Tawas, carrying freight and passengers; 4,000 passengers carried.

(*b*) *Flint, Shiawassee, and Bad rivers.*—This is a new work for which the river and harbor act of June 13, 1902, provides not to exceed $12,500, to be expended in the discretion of the Secretary of War, in dredging these streams up as far as St. Charles, in accordance with plan published in House Doc. No. 135, Fifty-fifth Congress, second session, and in the Annual Report of the Chief of Engineers for 1898, page 2600.

The object of the adopted project is to afford a reliable navigation for light-draft boats between St. Charles, on the Bad, and Saginaw, at the mouth of the Shiawassee, and to improve the Flint "as far as practicable" from its mouth by dredging a channel 50 feet wide and 6 feet deep. The estimated cost of this work is $20,000.

There were no operations during the past year.

July 1, 1901, balance unexpended	$16,217.29	
Amount appropriated by river and harbor act approved June 13, 1902	50,000.00	
		66,217.29
June 30, 1902, amount expended during fiscal year		252.42
July 1, 1902, balance unexpended		65,964.87
July 1, 1902, outstanding liabilities		10.00
July 1, 1902, balance available		65,954.87

(See Appendix N N 3.)

4. Sebewaing River, Michigan.—The original channel from Saginaw Bay to the mouth of Sebewaing River had an available depth of scant 4 feet. The first improvement was made in 1875, by which an entrance depth of 6 feet was provided through a narrow channel at a cost of $8,000, and this depth was increased to 7 feet in 1880–81 at a further

cost of $7,000. The river and harbor act of June 3, 1896, appropriated $5,000 for further operations, in accordance with a plan of improvement submitted in report of November 30, 1895 (printed as House Doc. No. 71, Fifty-fourth Congress, first session, and also in the Annual Report of the Chief of Engineers for 1896, p. 7743), which provides for extending the channel to the 8-foot contour in Saginaw Bay, a distance of about 15,000 feet from the river's mouth, and increasing its width and depth to 100 feet and 8 feet, respectively. The estimated cost was $37,000.

No work was done up to June 30, 1899, as sufficient funds were not supplied for commencing it until the appropriation contained in the river and harbor act of March 3, 1899, became available. Contract was made in 1899 to do the work, which was to be finished by September 30, 1900. Owing to the difficulties of the locality and to other causes, the contract is not yet finished, although it is hoped that the work will be completed during the present season.

The total amount of money estimated as necessary for completing the contemplated improvement is now available, and there is therefore no occasion for any further appropriation or estimate.

The total expenditure on the existing project to June 30, 1902, was $16,585.46.

COMMERCIAL STATISTICS.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1896	43,700	123,274	1899	13,088	127,450
1897	50,481	139,987	1900	24,200	118,225
1898	14,820	151,085	1901	17,625	77,998

July 1, 1901, balance unexpended	$28,474.15
June 30, 1902, amount expended during fiscal year	8,059.61
July 1, 1902, balance unexpended	20,414.54
July 1, 1902, outstanding liabilities	1,611.22
July 1, 1902, balance available	18,803.32
July 1, 1902, amount covered by uncompleted contracts	18,803.32

(See Appendix N N 4.)

5. Harbor of refuge at Sandbeach, Lake Huron, Michigan.—The site for this harbor, selected in 1872 after careful consideration, is on the west shore of Lake Huron, 60 miles north of its outlet into the St. Clair River, and the artificial harbor built there since then is the only safe refuge on that coast from the foot of the lake to Tawas Bay, 115 miles above. The work of construction was commenced in 1873 under a project providing for three sections of breakwater made of stone-filled cribwork, so located as to shelter a water area of some 650 acres, and for deepening this area by dredging where necessary. The estimated cost was $1,442,500. The sheltering breakwaters, with a total length of 8,132 feet, were completed in 1885, at a cost of about $975,000, and since that time expenditures have been applied to keeping them in repair, dredging, regulating and controlling the berthing of vessels entering the harbor for refuge, engineering supervision, and general office expenses.

The total expenditure to June 30, 1902, was $1,227,770.03.

The expenditure for the past fiscal year was applied to making some temporary repairs to superstructure of the main breakwater and to general contingencies, including custody of the harbor, supervision, control of vessels, office expenses, and a full and accurate survey of the entire harbor.

The number of vessels that entered the harbor for refuge during the past fiscal year was 1,427, with a total tonnage of 958,302. The grand total of vessels that have found shelter there from 1877 to 1901, inclusive, is 30,069, the tonnage of which aggregated 11,341,197. The vessels sheltered in 1877 averaged 289 tons each, and those during the year 1901 682 tons.

During the present fiscal year it is proposed to commence rebuilding the superstructure of the main breakwater of permanent materials.

July 1, 1901, balance unexpended	$290,095.62
For damage done to piers by steamer *Colgate Hoyt*	200.78
Amount appropriated by river and harbor act approved June 13, 1902	7,500.00
	297,796.40
June 30, 1902, amount expended during fiscal year	11,758.60
July 1, 1902, balance unexpended	286,037.80
July 1, 1902, outstanding liabilities	555.09
July 1, 1902, balance available	285,482.71

(See Appendix N N 5.)

6. Mouth of Black River, Rouge River, and Monroe Harbor, Michigan—(a) Mouth of Black River.—An extensive shoal and a bar formerly existed in the St. Clair River adjoining the mouth of the Black River. The bar lay close to the American side and obstructed approach to the Port Huron docks, while the shoal, forming a "middle ground" nearly 50 acres in extent, crowded the main channel in a sharp curve close to the Canadian shore. In 1871 a project was adopted for dredging the bar and middle ground to a uniform depth of 15 feet. Work was commenced in 1872 and completed in 1878. The whole area was redredged between 1889 and 1892 and again in 1897 to a depth of 16 feet.

The total expenditure to June 30, 1902, was $93,629.88.

No work was in progress during the past fiscal year. The shoal will re-form gradually, and as vessels of moderate draft habitually pass over this area instead of through the main channel, followed by those of deep draft, the maintenance of the improvement is highly desirable. Funds now in hand are sufficient for this purpose for the coming year.

(*b*) *Rouge River.*—This stream originally had a channel depth of from 10 to 17 feet from its mouth to the point at which the Wabash Railroad bridge crosses it, a distance of about 3 miles. During the years 1888 to 1892, inclusive, this part was improved by the Government so as to provide a minimum depth of 16 feet in a central channel 240 feet wide for a distance of 800 feet above the mouth, and thence 100 feet wide to the Wabash bridge. The cost of this improvement, originally estimated, was $31,690.39. The total expenditure to June 30, 1902, was $46,640.41, the result obtained being a 16-foot channel, as called for by the approved project, and its maintenance since 1892 to such extent as was necessary to meet the requirements of local com-

merce, but a gradual shoaling had taken place in the meantime, such as to limit navigation to vessels drawing 13 feet or less. Congress, by joint resolution approved April 11, 1898, authorized an extension of the improvement up to the Maples road, a distance of about 1½ miles above the Wabash Railroad bridge, limiting the expenditure for that purpose to $5,000.

The river was dredged in 1900, but the amount of money available was not sufficient to give the full channel width contemplated by the project for the entire distance. Between the Wabash Railroad bridge and Maples road the channel was dredged 50 feet wide. The Rouge is practically without current except in rainy weather and the channel will require constant dredging for maintenance.

No work was in progress during the past year.

COMMERCIAL STATISTICS.

Receipts and shipments by vessel, Rouge River.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1893	73,732		1898	117,486	10,259
1894	47,106		1899	92,631	763
1895	113,066	1,024	1900	119,712	4,600
1896	120,590	2,905	1901	105,533	782
1897	115,987	9,386			

(*c*) *Monroe Harbor.*—[This work was in the charge of Maj. Dan C. Kingman, Corps of Engineers.] The harbor of Monroe, Mich., is within the mouth of the Raisin River, at the western extremity of Lake Erie. In its natural condition the river flowed into the lake through several ponds and winding creeks. The depth of water at the deepest mouth of the river in its natural condition did not exceed 5 feet.

The project for the improvement of this harbor was adopted in 1834 and was practically completed in 1845. It had for its object to dredge a new and direct channel 100 feet wide and 10 feet deep from the lake across the marsh, a distance of 4,000 feet, to the portion of the river ordinarily used as a harbor. The sides of the canal were protected by a revetment and the entrance to the lake was protected by piers extending outward to a depth of 10 feet in the lake.

Subsequently the city of Monroe further improved the river channel by cutting a canal 1,400 feet long across a bend of the river.

The total expenditure to June 30, 1902, was $250,515.27.

There were no funds available for expenditure during the past fiscal year, and no work has been done. An inspection made June 24, 1902, indicates that the depth in the lake has been generally maintained and there is no special indication of a fill to be found there. Within the jetties, while the depth has generally been maintained, the width of the channel is somewhat reduced. The piers are in need of repairs.

From its size and depth of channel this harbor can not accommodate the larger class of vessels used upon the lake, and its commerce is not large. It is mainly used by excursion boats bringing passengers during the summer months. The deputy collector at this place reports that

between 40,000 and 50,000 passengers arrived and departed during the months of July and August, 1901.

The river and harbor act approved June 13, 1902, grouped this harbor with Black River and Rouge River, Michigan, and provided $7,500 for the maintenance of them all.

July 1, 1901, balance unexpended	$5,121.71
Amount appropriated by river and harbor act approved June 13, 1902	7,500.00
	12,621.71
June 30, 1902, amount expended during fiscal year	202.00
July 1, 1902, balance unexpended	12,419.71

(See Appendixes N N 6 and 7 and P P 1.)

7. Black River at Port Huron, Michigan.—The improvement of this stream was inaugurated by the river and harbor act of September 19, 1890, under a project which contemplated dredging it to a navigable depth of 16 feet from its mouth to the Grand Trunk Railway bridge, at an estimated cost of $75,000, and the act of July 13, 1892, directed that the improvement be extended 1,400 feet farther upstream, to Washington avenue. Operations were commenced in 1891 and continued until the summer of 1893, when the required 16-foot channel had been dredged throughout the designated limits to a width varying between 160 feet near the mouth and 50 or 75 feet in the contracted river sections above. The total length of channel so dredged was 9,700 feet. Before improvement the minimum channel depth was between 8 and 10 feet for about 1 mile from the mouth of the river, but only 6 to 8 feet from there up to Washington avenue. The narrow upstream section and some shoal spots in the wider section below were redredged in 1897.

The total expenditure to June 30, 1902, was $46,304.97.

Experience and observation show that the narrow dredged channels in the upper limits of the improvement can have no considerable degree of permanence, although the canal to be cut by the city of Port Huron from Lake Huron to the Black River in the upper part of the town for the purpose of flushing the stream should, if it has any effect, retard the deterioration somewhat.

Dredging is necessary for maintaining this improvement.

COMMERCIAL STATISTICS.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1893	175,081	7,487	1898	151,606	16,595
1894	116,535	4,413	1899	130,675	37,368
1895	104,850	6,825	1900	105,931	181
1896	186,987	2,569	1901	120,018	100
1897	96,925	1,455			

July 1, 1901, balance unexpended	$695.03
July 1, 1902, balance unexpended	695.03

(See Appendix N N 8.)

8. Pine River, Michigan.—The $5,000 appropriated for this river in 1875 was applied in dredging a channel 12 feet deep for a distance of 4,000 feet from the mouth of the river. This channel gradually shoaled.

The present project, adopted in 1895, provided for a channel 100 feet wide and 14 feet deep for a distance of 2,500 feet from the mouth of the river, thence 75 feet wide and 12 feet deep to Belknap's brick yard, a total distance of 5,800 feet. The estimated cost was $10,560. This project was completed under two contracts, one in 1896, the other in 1899, all dredging being in Pine River.

The amount expended on this project to June 30, 1902, was $9,224.59.

No work was in progress during the past year.

COMMERCIAL STATISTICS.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.
	Tons.	*Tons.*
1898	100,608	1,150
1899	734,725	7,060
1900	370	5,173
1901	237	2,145

July 1, 1901, balance unexpended	$1,593.11
June 30, 1902, amount expended during fiscal year	257.70
July 1, 1902, balance unexpended	1,335.41

(See Appendix N N 9.)

9. Belle River, Michigan.—The original project for this river, adopted in 1880, contemplated the formation of an ice harbor of refuge by dredging a channel 50 feet wide with depths of 13 feet and 12 feet. This work was completed between 1881 and 1885.

This channel having shoaled, the present project was adopted in 1895. It provides for a channel 75 feet wide, 15 feet deep from the St. Clair River to the Bridge Street Bridge, and 14 feet from that point to the Broadway Bridge, a total distance of 5,400 feet. The estimated cost was $21,340. This work was accomplished in two contracts from 1896 to 1899, all dredging being in Belle River.

The principal use of the improvement is as an ice harbor of refuge.

No work was in progress during the past year. The whole amount expended on the project to June 30, 1902, was $10,940.46.

COMMERCIAL STATISTICS.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1897	11,396		1900	23,371	4,548
1898	10,044	3,550	1901	15,616	2,928
1899	5,573	878			

July 1, 1901, balance unexpended	$4,059.54
July 1, 1902, balance unexpended	4,059.54

(See Appendix N N 10.)

10. Clinton River, Michigan.—This stream empties into Anchor Bay, in the northwesterly part of Lake St. Clair, and before improvement had a channel depth of about 10 feet, except at several shoals, over which but 5 or 6 feet could be carried, and a broad flat at the mouth with a general depth of from 3 to 4 feet. In 1870–71 a channel 9 feet deep, 60 feet wide, and 2,700 feet long was dredged through this flat, but being left without works of protection, it soon filled up again. In 1885 a project of general improvement was adopted, which provided for a through channel 8 feet deep to Mount Clemens (8 miles upstream), for a pile dike extending across the flat at the mouth to the curve of 10 feet depth in the bay, and for revetments, as needed above. The estimated cost, as modified in 1889, was $34,564.

The total expenditure to June 30, 1902, was $68,261.59, of which $25,500 was applied to occasional and scattering work done before the adoption of the general project of 1885, leaving $42,689.06 as the amount applied to the latter.

The character of the stream and engineering conditions are stated in the Annual Report of the Chief of Engineers for 1896, page 2736. It is not possible to make the improvement permanent without an expenditure disproportionate to the commerce of the river, and its maintenance can best be accomplished by periodical dredging, as has been done in the past.

COMMERCIAL STATISTICS.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1896	30,749	410	1899	35,525	
1897	29,077		1900	32,410	282
1898	29,085		1901	36,925	

July 1, 1901, balance unexpended	$6,823.46
June 30, 1902, amount expended during fiscal year	21.05
July 1, 1902, balance unexpended	6,802.41

(See Appendix N N 11.)

IMPROVEMENT OF WATERS CONNECTING THE GREAT LAKES.

This district was in the charge of Col. G. J. Lydecker, Corps of Engineers, to January 28, 1902, and of Maj. W. H. Bixby, Corps of Engineers, since that date. Division Engineer, Lieut. Col. O. H. Ernst, Corps of Engineers, since January 28, 1902.

1. Ship channel connecting waters of the Great Lakes between Chicago, Duluth, and Buffalo.—Before the Government commenced the improvement of this water route the freight was largely carried by sailing vessels, and these and the few steamboats were limited in size to less than 350 feet length, 70 feet breadth, and 12 feet draft, this being the size of the Sault locks up to 1870. The total commerce in 1870 passing the Sault was less than 700,000 tons, or less than one-fortieth of that of 1901.

Prior to 1892 the improvement of this waterway was limited to individual places and local work, explained elsewhere under the heads

of St. Marys River, Hay Lake, Lake St. Clair, St. Clair River, and Detroit River.

The present project was adopted by the river and harbor act of July 13, 1892, the object being to provide a navigable depth of 20 feet by excavating channels to a minimum width of 300 feet through the shoal places in the specified waters at an estimated cost of $3,340,000, and work was commenced under approval of the War Department dated October 20, 1892.

The water surface has an oscillation varying from a few inches in many days during calms to about 2 feet per day in variable weather, and as much as 6 feet in Lake Superior and 8 feet in Lake Erie during hurricanes, and the daily mean may change from 0.5 to 2 feet per year, or as much as 4 feet during forty years.

More extended information with sketches or maps may be found in Annual Reports of the Chief of Engineers for 1886, pages 1792–1808, and 1895, pages 3052–3062 (special history Lake Superior to Huron); 1896, pages 2881–2889 (special history St. Clair River and Canal); 1891, pages 2794–2801 (special history Detroit River); 1895, page 2866 (map from Lake Superior to Lake Huron), and 1896, page 2758 (map from Lake Huron to Lake Erie).

Operations were commenced in the spring of 1893, and by 1897 channels of the required widths of 300 feet or more had been excavated through all the shoal areas that were considered when the project was adopted, and to 20 feet depth below the mean low-water surface as estimated at the time of the project. The maximum draft that could be carried over these shoals before improvement was from 15 to 16 feet at mean stage of water. Work since that time has been applied to increasing the width of channels at angles and other critical points and to removing numerous isolated shoals of comparatively small area that have been found in the through line of travel. In many instances there was no knowledge of the existence of the shoals, but in most cases they have been found in the course of surveys or examinations with a sweeping raft. The total expenditure on the improvement to June 30, 1902, was $2,992,058.67.

The present commerce is about forty times that of 1870, six times that of 1886, and five times that of 1892.

During the past fiscal year there were removed from the St. Clair River section of the ship channel portions of three shoals at St. Clair, Stag Island, and Grande Pointe, the total amount of material dredged being 86,753 cubic yards. The result of the work was to provide a clear depth of 21 feet where the controlling depths before improvement ranged from 16½ to 18 feet. In the St. Marys River section there were found two new shoals near Frying Pan Island and Crab Island, both near the direct line of navigation and with less than 21 feet depth, both being mapped and reported to the lake survey office and other navigation interests. Surveys and examinations with sweeping rafts during summer and ice boring and sounding apparatus during winter were continued over the remaining unsurveyed areas of St. Marys and St. Clair rivers. (For other like work along this route see reports on Hay Lake and Detroit River.)

The unexpended balance of previous appropriations will suffice for all work required to complete improvements contemplated by the present approved project.

The amount of freight carried through the St. Marys River section of this channel during the navigable season of 1901 was 28,403,065 tons, valued at $289,906,865. Reliable statistics of traffic through the Detroit River are not obtainable, but such as could be procured indicate that about 48,000,000 tons of freight passed during that season.

July 1, 1901, balance unexpended	$380,705.27
June 30, 1902, amount expended during fiscal year	29,985.88
July 1, 1902, balance unexpended	350,719.39
July 1, 1902, outstanding liabilities	1,048.34
July 1, 1902, balance available	349,671.05

(See Appendix O O 1.)

2. St. Marys River at the falls, Michigan.—Commercial navigation of the falls, or rapids, of this river at Sault Ste. Marie was impracticable until 1855, when the State of Michigan constructed a canal and double lock which provided a convenient navigable channel for vessels whose draft did not exceed 11.5 feet (12 feet in 1870) at mean stage of water. This improvement was completed in 1855, the double lock having chambers of 350 feet length and 70 feet width with gate openings 70 feet width arranged for 9 feet average lift at each lock, and the canal being about 5,400 feet long, with an available width of 70 feet and a top width of 100 feet. The commerce was in 1870 about 700,000 tons per year.

In 1870 the United States entered upon a project for increasing the canal to at least 100 feet width, building a new lock, and providing for 16 feet draft. The new lock (now known as the Weitzel lock) was opened to traffic in 1881, its single chamber being of 515 feet length and 80 feet width, with gate openings of 60 feet width, arranged for 18 feet average lift. The cost of the work from 1856 to 1885 inclusive was $2,875,692, including $10,000 diverted from the 1864 Great Lakes appropriation. A rapidly increasing commerce developed as a result of these improvements.

The present project, presented in reports dated October 18 and December 22, 1886, and which provided for building a new single-lift lock on the site of the old State locks, with a chamber of 800 feet length and 100 feet width and 21 feet of water over miter sills, and with gate openings of 100 feet width arranged for a lift of from 16 to 21 feet, the canal, together with its approaches, to be deepened to correspond, all at an estimated cost of $4,738,865, was started by the river and harbor acts of August 5, 1886, and adopted by that of August 11, 1888, and work was commenced under the approval of the War Department as given on October 28, 1886. The essential features of this project were so far completed in 1896 as to permit the new lock to be opened to navigation August 3 of that year, this lock being now known as the Poe lock. Work since that time has consisted in completing the deepening of the canal and its approaches, rebuilding and extending piers, grading and improving canal grounds, etc. The total expenditure to June 30, 1902, was $3,996,948.25. Commerce is now about forty times what it was in 1870 and about six times that of 1886.

The water surface, usually changing slowly, may rise or fall as much as 6 feet during a severe storm, and the daily mean may change as much as 2 feet in one year or 4 feet during forty years.

The river and harbor act of June 13, 1902, authorized the diversion of $20,000 of existing funds for special improvement of Sailors Encampment, Hay Lake; $20,000 for salaries and expenses of a special Great

Lakes and St. Lawrence River International Commission; a sufficient amount (probably about $80,000) for the completion of certain new improvements of St. Clair Flats Canal, for which existing funds were insufficient, and extended the work at the falls so as to include widening and further improvement of the canal above the locks in the manner explained in House Doc. No. 128, Fifty-sixth Congress, second session.

More extended information may be found in Annual Reports of the Chief of Engineers for 1886, pages 1792–1808 (special history); 1895, page 2866 (map); 1895, pages 3052–3062 (special history).

The commerce passing the falls during the navigation season of 1901, a period of 246 days, comprised 28,403,065 tons of freight, valued at $289,906,865; the number of passengers reported during the same period was 59,663.

July 1, 1901, balance unexpended	$794,474.51
June 30, 1902, amount expended during fiscal year	27,518.20
July 1, 1902, balance unexpended	766,956.31
July 1, 1902, outstanding liabilities, and diversions under act of June 13, 1902	121,493.94
July 1, 1902, balance available	645,462.37

(See Appendix O O 2.)

3. Operating and care of St. Marys Falls Canal, Michigan.—The former condition and results of improvement are the same as above stated for St. Marys River at the falls.

During the fiscal year ending June 30, 1902, the United States canal was open to navigation 251 days, the closed season being from December 11, 1901, to April 5, 1902. A total of 17,749 vessels, aggregating 26,077,256 registered tons, and carrying 30,037,401 tons of freight and 29,847 passengers, passed through the locks in 9,417 lockages. The Canadian canal at Sault Ste. Marie, Ontario, open 265 days, passed 4,745 vessels in 3,260 lockages, carrying 3,085,045 tons of freight and 35,724 passengers, making the combined traffic through the two canals 33,122,446 tons of freight and 65,571 passengers. This is an increase during the year of 40 per cent in tons and 5 per cent in passengers.

The principal items of freight during the past fiscal year through both canals were: Iron ore, 21,562,677 tons; coal, 5,111,928 tons; flour, 8,382,714 barrels; wheat, 67,829,440 bushels; other grain, 23,954,685 bushels; lumber, 1,153,977,000 feet B. M.; and general merchandise, 622,259 tons.

Other statistics in relation to this traffic and commerce are summarized in the following statements:

Summary of traffic through St. Marys Falls Canal, Michigan, for the fiscal year ending June 30, 1902.

Number of vessels through Weitzel lock	7,132
Number of vessels through Poe lock	10,617
Number of lockages through Weitzel lock	4,316
Number of lockages through Poe lock	5,101
Total registered tonnage	26,077,256
Total freight tonnage	30,037,401
Total time spent in making lockages	4,892 hrs.
Average time spent in making a lockage	31 min. 17 sec.
Total time spent by vessels in passing locks	9,956 hrs. 49 min.
Average time spent by vessels in passing locks	33 min. 40 sec.
Cost per lockage	$9.12
Cost per passage	$4.84
Cost per registered ton	3.29 mills
Cost per freight ton	2.86 mills

The Weitzel lock was open to navigation 225 days, from July 1 to December 4, 1901, and from April 24 to June 30, 1902.

The time for the Poe lock was 251 days, July 1 to December 11, 1901, and from April 5 to June 30, 1902.

Summary of St. Marys River commerce, via American and Canadian canals, during the calendar season of 1901, viz, from April 20, 1901, to December 21, 1901, a period of 246 days.

Total mile-tons	23,383,861,987
Total freight carried, net tons	28,403,065
Total valuation placed on freight carried	$289,906,865
Average value per ton of freight carried	$10.21
Total amount paid for freight transportation	$23,217,974.07
Average distance freight was carried, miles	823.3
Cost per mile per ton, mills	.99
Average cost per ton for freight transportation	$0.82
Total number registered vessels using canals	893
Total number of passages by unregistered crafts carrying freight	413
Time American lock was operated, days	230
Time Canadian lock was operated, days	246
Total valuation placed on registered vessels	$60,556,100
Total number of passengers transported	59,663
Freight carried by—	
Registered vessels, tons	28,353,265
Unregistered vessels, tons	49,800
American vessels, per cent	96
Canadian vessels, per cent	4
Passengers carried by—	
American vessels, per cent	28
Canadian vessels, per cent	72

In addition to the above there is a local freight of between one-fourth and one-half million tons, and a local passenger traffic of several thousand passengers in the lower river below the canals, as to which definite figures have not yet been secured.

This service is provided for from the permanent-indefinite appropriation for operating and care of canals and other works of navigation under section 4 of the river and harbor act of July 5, 1884. The total expenditure on this account from 1881, when the Weitzel lock was first put in service, to June 30, 1902, amounts to $1,056,022.71, of which $87,693.80 related to operations during the past fiscal year. The growth of freight traffic during the same period is shown by the following tabular statement:

Freight traffic.

	Tons.		Tons.
1881	1,567 741	1892	11,214,333
1882	2,029 521	1893	10,796,572
1883	2,267 05	1894	13,195,860
1884	2,874,557	1895	15,062,580
1885	3,256,628	1896	16,239,061
1886	4,527 759	1897	18,982,755
1887	5,494,649	1898	21,234,664
1888	6,41 423	1899	25,255,810
1889	7,516,022	1900	25,643,073
1890	9,041,213	1901	28,403,065
1891	8,888,759		

(See Appendix O O 3.)

4. Hay Lake and Neebish channels, St. Marys River, Michigan.—The original conditions of this waterway are about the same as already explained for the ship channel and St. Marys River at the falls.

On account of rapids and shoals that intervened between the navigable channel of the river and the lake at its head and foot, this channel was not navigable for commercial purposes before improvement.

The original project of improvement of 1882 contemplated the excavation of channels 17 feet deep and 300 feet wide through all obstructed portions of the Hay Lake route; but this project, modified in 1885 to provide a depth of 20 feet and to widen at angles and critical points, at a total estimated cost of $2,659,115, was adopted by river and harbor act of August 5, 1886. The work of improvement was commenced in 1883, under War Department approval of October 27, 1882, and the route opened to commerce June 7, 1894, though full width and depth of channel had not then been obtained at all points; but since then several shoals in the deep-water section of the lake have been removed, and the dredged channels have been widened at critical places.

The river and harbor act of June 13, 1902, appropriated $500,000 and authorized work up to $4,000,000 more for the completion of the Hay Lake and Middle Neebish channel project, and the commencement and prosecution of work upon a second channel of like dimensions from Hay Lake through the West Neebish to Mud Lake, so as to provide 21 feet minimum low-water depth over 300 feet minimum width of channel way from St. Marys Falls Canal to Lake Huron for descending boats, and an additional 300-foot width for ascending boats.

The amount expended to June 30, 1902, was $2,317,596.96, and the improvement as it stood at that date comprised 10 miles of channel dredged to a depth of 20 or 21 feet, in 6 miles of which the width was 300 feet and the remaining 4 from 450 to 1,100 feet. The new channel is 11 miles shorter than the old one via Lake George. It can be navigated with reasonable safety at night, which could not be done by the old route, and it is available for vessels drawing 5 feet more water than could be safely carried through the latter. The commerce is now about 33,000,000 tons per year.

The water surface, usually changing slowly, may rise or fall 2 feet during a severe storm, and the daily mean may change as much as 2 feet in one year or 4 feet during forty years.

More extended information with sketches or maps may be found in Annual Reports of the Chief of Engineers for 1886, pages 1792–1808 (special history), 1895, page 2866 (map), and 1895, pages 3052–3062 (special history).

Operations during the past fiscal year were applied to widening the channel at Little Rapids so as to secure a full 600-foot width at this difficult locality, work being done under continuous contracts. Extensive surveys were made with reference to further improvements.

The whole commerce of the St. Marys River passes through this channel, except small river steamers engaged in local traffic and rafts of logs, which continue to be taken via the old channel as a measure of safety to general commerce. The following tabular statement indicates the extent and growth of this commerce from the year in which this route was opened for travel.

Season of navigation.	Freight.	Valuation.	Passengers.
	Tons.		
1894	13,195,860	$143,114,502	27,236
1895	15,062,580	159,575,129	31,656
1896	16,239,061	195,146,842	37,066
1897	18,982,755	218,235,927	40,213
1898	21,234,664	233,069,739	43,426
1899	25,255,810	281,364,750	51,050
1900	25,643,073	267,041,959	58,555
1901	28,403,065	289,906,865	59,663

Funds now available under past appropriations will be applied toward increasing the width of the Little Rapids division of this channel from its present minimum of 300 feet up to a uniform width of 600 feet, and the work will be done under continuing contracts as authorized by the river and harbor act of March 3, 1899, all the funds ($494,115) having now actually been appropriated. These contracts are already in progress and will be completed at an early date. Under the funds and authority of the June 13, 1902, appropriation new contracts will be entered into upon the new completion of the old channel via the Middle Neebish and commencement of the new channel via the West Neebish, and $800,000 will be needed under sundry civil act in 1903 for the next year's work.

July 1, 1901, balance unexpended	$303,094.22
Amount appropriated by river and harbor act approved June 13, 1902.	500,000.00
Amount appropriated by sundry civil act approved June 28, 1902	144,115.00
	947,209.22
June 30, 1902, amount expended during fiscal year	105,548.71
July 1, 1902, balance unexpended	841,660.51
July 1, 1902, outstanding liabilities	48,730.76
July 1, 1902, balance available	792,929.75
July 1, 1902, amount covered by uncompleted contracts	264,796.41
Amount (estimated) required for completion of existing project	4,000,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	800,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix O O 4.)

5. St. Clair Flats Canal, Michigan.—Before the Government commenced work, in 1855, at this locality, boats were obliged to follow the natural delta outlet channels of the St. Clair River where the draft was less than 11 feet in order to get from the river into the St. Clair Lake.

Between 1855 and 1865 the Government spent $45,000 in gaining 1 or 2 feet depth temporarily through these delta channels.

The present improvement dates from 1866, and proposed a straight dredged cut across a flat where the depth was only about 6 feet, the object being to secure 13 feet depth over 300 feet width of channel, modified in 1872 to give 16 feet and in 1886 to give 18 and 20 feet, all at a total cost of $1,326,060, as adopted by the river and harbor acts of June 23, 1866, and September 19, 1890, and approved by the War Department under various dates from 1866 up to October 9, 1890. This work was practically completed to 18 feet depth by 1892, after which it was incorporated into the 20–21 foot ship channel.

The dredged material was deposited so as to form dikes on each side of the cut, the channel faces of which are sustained by substantial sheet-pile revetments. In its present condition the width of waterway between revetments is 292 feet, depth of water 20 feet at mean stage in channel 260 feet wide, and length of each lateral dike 7,221 feet.

The water surface, usually changing slowly, may rise or fall 2 feet during a severe storm, and the daily mean may change as much as 2 feet in one year or 4 feet during forty years.

The river and harbor act of June 13, 1902, appropriated $330,000 and authorized the diversion from the St. Marys Falls appropriation of as much more as might be needed (probably $80,000) to commence

and complete a second channel of 20 feet depth over 300 feet width alongside the existing channel, so as to provide two separate channels, one for ascending and one for descending boats.

The total amount appropriated for this improvement from its beginning, in 1866, is $1,094,810, and the total expenditure to June 30, 1902, $762,650.61.

The present commerce is greater than that of the St. Marys Falls Canal and less than that of Detroit River, being between the two, and is roughly estimated at about 44,000,000 tons per year, being mostly through freights from Lake Erie to either Lake Superior or Lake Michigan.

More extended information may be found in Annual Reports of the Chief of Engineers for 1896, pages 2881–2889 (special history), and 1896, page 2758 (map).

No special operations were in progress or expenditure made during the past fiscal year.

The old unexpended balance of $3,059.39 will probably be applied during the ensuing fiscal year to repairing and extending the protecting pile work at the head and foot of the canal dikes. The new appropriation will commence the widening.

July 1, 1901, balance unexpended	$3,059.39
Amount appropriated by river and harbor act approved June 13, 1902	330,000.00
	333,059.39
June 30, 1902, amount expended during fiscal year	900.00
July 1, 1902, balance unexpended	332,159.39

(See Appendix O O 5.)

6. Operating and care of St. Clair Flats Canal, Michigan.—This service is provided for by the permanent-indefinite appropriation for operating and care of canals and other works of navigation, under the provisions of section 4 of the river and harbor act of July 5, 1884.

Operations during the past fiscal year were of the same routine character as have been carried on since the canal was opened to traffic in 1871, viz, a custodian was present during the season of navigation to watch the passage of vessels, enforce regulations respecting traffic through the canal, and supervise all work required for the care and repair of the canal dikes. The expenditure on this account during the year up to June 30, 1902, was $87,093.56, of which $2,121.97 was for the service of the preceding fiscal year.

(See Appendix O O 6.)

7. Detroit River, Michigan.—Before improvement the shoalest part of the channel through Detroit River was at the Limekiln Crossing, where the normal depth was 12½ to 15 feet over a bottom of solid rock.

The first projects of 1874 provided for a winding channel of at least 20 feet depth over 300 feet width, modified in 1883 so as to somewhat straighten such channel, in 1886 to give 400 feet width, in 1888 to give 440 feet width. The general depth above and below the Limekiln was 20 feet or more, but the bed of the river was studded with large bowlders and rocky shoals, which limited the safe navigable depth to scant 15 feet through a distance of about 12 miles.

A new general project of improvement was thereupon adopted in 1892 for the removal of all obstructive shoals between the city of Detroit and Lake Erie, with a view to obtaining a through channel *with a least* width of 600 feet and navigable depth of 20 feet, at a total

estimated cost of $1,554,500, as adopted by river and harbor acts of July 13, 1892, and March 3, 1899, and as approved by the War Department at various dates from 1892 up to July 3, 1899, and all of this amount having now (since the enactment of the sundry civil act of June 28, 1902) been actually appropriated.

The river and harbor act of June 13, 1902, appropriated $500,000 and authorized work up to $1,250,000 more for the commencement and prosecution of the new 1900 project so as to provide 21 feet minimum low-water depth over 600 feet minimum width of channel from Lake St. Clair through Detroit River to Lake Erie.

The total expenditure on the improvement up to June 30, 1902, was $1,266,125.76. As a result of the work done to that date, a channel ranging from 300 to 600 feet in width was obtained, in which the least depth at mean stage of water was 19 feet, and from 19 to 21 feet through most of the distance.

The commerce is now roughly estimated at 48,000,000 tons per year, being mainly through freight from Lake Erie to lakes Superior and Michigan, or from those places to Detroit, being more than twice that of 1892.

For the head of the river at Grossepoint a preliminary examination was favorably reported December 26, 1888, followed by survey reports of February 8, 1890 (printed together as House Ex. Doc. No. 200, Fifty-first Congress, first session; also Annual Report of the Chief of Engineers for 1890, pp. 2749–2752), with estimates of $553,300 for 19.5 feet depth over 800 feet width, and $690,800 for 20 feet depth.

More extended information may be found as follows: Annual Reports of the Chief of Engineers for 1891, pages 2794–2801 (special history), and 1896, page 2758 (map).

Operations were in progress during the past fiscal year under three continuing contracts, and work by hired labor with Government plant, the result of which was to increase the minimum depth of the improved channel to 21 feet below present mean low water wherever work is being done. Extensive surveys relating to work in progress and projects for more extensive improvements were also made.

The contracts already in progress under old appropriations will probably be completed in 1903. The new work under the authority and funds of the June 13, 1902, act will be started either this fall or early in 1903 under new contracts, and $450,000 will be needed under sundry civil act in 1903 for the next year's work.

July 1, 1901, balance unexpended	$490,102.16
Amount appropriated by river and harbor act approved June 13, 1902.	500,000.00
Amount appropriated by sundry civil act approved June 28, 1902	136,500.00
	1,126,602.16
June 30, 1902, amount expended during fiscal year	338,117.51
July 1, 1902, balance unexpended	788,484.65
July 1, 1902, outstanding liabilities	84,662.41
July 1, 1902, balance available	703,822.24
July 1, 1902, amount covered by uncompleted contracts	176,654.93
Amount (estimated) required for completion of existing project	1,250,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	450,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix O O 7.)

8. Removing sunken vessels or craft obstructing or endangering navigation.—One wreck was removed from St. Marys River, and the removal of another in the St. Clair River was almost completed.

An allotment was made for removing a wreck in the Straits of Mackinac.

(See Appendix O O 8.)

SURVEYS REQUIRED BY THE RIVER AND HARBOR ACT OF MARCH 3, 1899.

The local officer was also charged with the duty of making surveys of *Detroit River from Detroit to Lake Erie*, and of *waters connecting lakes Superior and Huron, including Hay Lake Channel, St. Marys River, Michigan*. Preliminary reports have been transmitted to Congress and printed in Annual Report of the Chief of Engineers for 1900, page 4015, and for 1901, page 3200, respectively. It is expected that final reports will be submitted in time for transmission to Congress at the opening session of the Fifty-eighth Congress.

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS ON LAKE ERIE WEST OF ERIE, PA.

This district was in the charge of Maj. Dan C. Kingman, Corps of Engineers. Division Engineer, Col. S. M. Mansfield, Corps of Engineers, to July 24, 1901, and Lieut. Col. O. H. Ernst, Corps of Engineers, since that date.

1. Toledo Harbor, Ohio.—The harbor of Toledo is in the Maumee River. The wharf frontage on the river extends over a distance of about 3 miles, the lower end of which is about 4 miles above the mouth of the river, at the head of Maumee Bay.

Originally the channels in the river were much better than in the bay, having minimum depths of 14 to 16 feet, while in the bay the least depths were 8.5 feet and the maximum depth for most of the distance was but 12 feet.

In 1866 a project was adopted to dredge the channels of deepest water in the bay to a depth of 12 feet. The project was amended from time to time until 1887, when the old indirect channel had a minimum depth of 15 feet.

In 1887 a project was adopted for a straight channel through Maumee Bay, with a depth of 17 feet and a bottom width of 200 feet. The estimate of cost, including dikes or other channel protections, was $1,875,000.

The project for straight channel was amended in 1893 by increasing the width of outer section about 3 miles long to 300 feet. Since 1892 the improvement has been extended to include the Maumee River.

The river and harbor act of March 3, 1899, appropriated $150,000 for—

> Improving harbor at Toledo, Ohio, by providing a straight channel through Maumee River and Bay four hundred feet in width and twenty-one feet deep, in accordance with the project dated December sixteenth, eighteen hundred and ninety-seven, * * * *Provided*, That a contract or contracts may be entered into by the Secretary of War for such materials and work as may be necessary to complete the said project, to be paid for as appropriations may from time to time be made by law, not to exceed eight hundred thousand dollars, exclusive of the amount herein and heretofore appropriated.

This then is the present project for improving the harbor at Toledo, Ohio.

Of the amount appropriated in the river and harbor act of March 3, 1899, the sum of $100,000 was allotted for operating and maintaining

the United States dredge plant to dredge the channels south of the Wheeling and Lake Erie Railroad bridge. A continuous contract authorized by law was entered into with the Lydon & Drews Company, of Chicago, Ill., and was approved September 23, 1899.

The total expenditure for improving and maintaining channels in Maumee River and Bay to June 30, 1902, was $1,906,976.96.

As all of this money was expended for the purpose of securing artificially deepened channels, much of the work was temporary in character and amounted simply to maintenance. The net result on June 30, 1901, was a channel not less than 200 feet wide from the Cherry Street Bridge outward through the river and bay for a distance of 13 miles, and the depth in this channel was nowhere less than 17 feet. Much of it had been deepened to 21 feet, and work was in progress to give it this depth throughout.

During the past year the contractor removed 1,151,300 cubic yards of material, and the total amount excavated to date, including that done by the United States dredge, is 2,789,337 cubic yards. Before the close of the season of navigation of 1901 the full depth of 21 feet for a width of 200 feet had been secured from Cherry Street Bridge to the lake.

A recent examination shows a decided tendency to fill in the dredged channel. Over the middle section of the channel the fill was at the rate of 1½ feet in depth per annum, but in other portions of the channel which have been excavated for a longer time the rate of fill was very much less. The result, however, is such as to demonstrate the necessity for an adequate hydraulic dredge in order to maintain this artificial channel after it has once been secured. The river and harbor act of June 13, 1902, authorizes the purchase of such a dredge and the payment of the sum of $40,000 toward it, to be taken from the money appropriated for the harbor of Toledo, Ohio, under the river and harbor act of March 3, 1899.

The commerce of Toledo for the calendar year 1901 was 3,086,364 tons, an increase of about 88,000 tons over that of the previous year. The deep channel was not available until about the close of the season of navigation of 1901, and could not, therefore, be taken advantage of. A marked increase in the commerce of this port is looked for in the next year.

July 1, 1901, balance unexpended	$143,411.51
Amount appropriated by river and harbor act approved June 13, 1902	15,000.00
Amount appropriated by sundry civil act approved June 28, 1902	223,000.00
	381,411.51
June 30, 1902, amount expended during fiscal year	137,687.55
July 1, 1902, balance unexpended	243,723.96
July 1, 1902, outstanding liabilities	12,824.76
July 1, 1902, balance available	230,899.20
July 1, 1902, amount covered by uncompleted contracts	668,686.10
Amount (estimated) required for completion of existing project	436,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	200,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix P P 2.)

2. Port Clinton Harbor, Ohio.—The harbor of Port Clinton is within the mouth of the Portage River. This river flows into Lake Erie at a point about 13 miles by land and 22 miles by lake west of the city of Sandusky. In its natural condition the depth of water on the bar at the mouth of the river rarely exceeded 5 feet.

The project for its improvement was adopted in 1871 and slightly modified in 1872 and 1873. It provided for the construction of two parallel jetties extending outward from the mouth of the river to a depth of 10 feet of water in the lake.

The work done consisted mainly of sheet piling of oak plank, secured and reenforced by oak piles, with heavy oak waling pieces. The pierhead of the east jetty was a solid construction of piles and stone, and 720 linear feet of west jetty consisted of a substructure of piles with superstructure of timber crib work, both filled with stone.

The jetties were extended to a depth of 10 feet in the lake in 1883. Since then no further extension has been made. The channel was dredged to a depth of 10 feet and a width of 100 feet between the jetties and a width of 200 feet inside the shore line in 1893 and 1894. The current in the river has been sufficient to maintain fairly well the depth thus artificially secured. The jetties, having become very much decayed, have been partially protected by stone piled against them on both sides, giving a slope of about one on one. This stone is in turn protected by a covering of large stone which above water is roughly laid as a pavement.

The present project merely provides for completely protecting the old wooden jetties in this manner.

The total amount expended to June 30, 1902, was $93,346.47.

At the beginning of the past fiscal year a contract was in force for continuing the work of protecting the old jetties. The contract was completed and closed on August 24, 1901, 3,249½ tons of stone having been placed in the revetment. This makes a total of 13,269 tons of stone thus used, and while it does not complete the proposed work it leaves the jetties in a fairly good condition. The natural depth in the lake beyond the end of the jetties is less than that in the dredged channel between them, so that the full advantage of the improvement is not attained.

The river and harbor act of June 13, 1902, appropriates $5,000 for continuing the improvement. The greater portion of this will be applied to deepening the channel in the lake by dredging.

The commerce of Port Clinton is not large. The total amount reported for the calendar year 1901 was 9,629 tons.

July 1, 1901, balance unexpended	$5,881.62
Amount appropriated by river and harbor act approved June 13, 1902	5,000.00
	10,881.62
June 30, 1902, amount expended during fiscal year	5,228.09
July 1, 1902, balance unexpended	5,653.53

(See Appendix P P 3.)

3. Sandusky Harbor, Ohio.—The harbor of Sandusky is in the lower part of Sandusky Bay, along the city front, the part nearest to the lake being about 2 miles from the bar which divides the waters of the bay from those of the lake. In its natural condition the depth was only such as the bay afforded, which was about 10 feet along the city front and from 9 to 12 feet thence to the lake.

A long, flat sand bar divided the bay from the lake, this bar being cut through by a channel, from 1,000 to 2,000 feet in width, near its central portion. The southern part of the bar is called "Cedar Point" and the northern "Sand Point." Between these two points the currents between the bay and the lake, resulting from the action of the wind and from varying barometric pressures, had scoured out the channel to a depth of not less than 18 feet for a distance of a mile or more, the maximum depth being as great as 40 feet. This place has always been known as the "Deep Hole."

The first appropriation was made for a survey in 1826, and the first improvement was made in 1844, consisting in the construction of a dam to close a breach across Sand Point. With this exception all the improvements made previous to 1896 consisted in deepening natural channels and in making a new straight channel from the city front to Cedar Point and in removing sand and bowlders from the dock channel along the city front. Natural causes have washed away a greater part of Sand Point since 1826, and there is now a space of about 7,000 feet between the edge of the Deep Hole and Sand Point in which the water has a depth of from 2 to 6 feet.

In 1896 and subsequently the project has been added to so as to provide for the construction of a stone jetty upon a mattress foundation extending from Cedar Point outward, with a view to confining and directing the flow of water to and from the bay. Additional provision was also made for a spur upon the other side of the Deep Hole and a short piece of jetty, and for the protection by a mattress covering of a portion of the bank of the channel and the point of the bar near the light-house.

The total expenditure for improving Sandusky Harbor from 1844 to June 30, 1902, was $556,427.42.

This expenditure resulted in the dredging as above described, and in the construction of a portion of the sill, jetties, dikes, and mattress which the plan provided for. In all, about 12½ per cent of the latter class of work has been accomplished.

In compliance with the emergency river and harbor act of June 6, 1900, a new project was prepared with a view to obtaining and maintaining a channel 21 feet deep at mean lake level, with a width of 400 feet in the approaches to the harbor front and 300 feet in the harbor channels. This project was adopted by the river and harbor act of June 13, 1902. It is published on page 3275, Annual Report of the Chief of Engineers for 1901, and is, in effect, an enlargement of the project of 1896, and differs from it only in providing for wider and deeper channels. The present project, therefore, calls for the construction of certain dike, sill, and jetty work, for channel protection and regulation, and for dredging and removal of rock.

The balance of funds available at the beginning of the past fiscal year was only $788.06. No operations were possible until the end of the year, when a small amount of dredging was done by the United States dredge in order to remove certain lumps and ridges which seriously obstructed navigation upon the outer bar. About 6,000 cubic yards of material was thus removed, giving a depth along the axis of the channel sufficient to accommodate the largest vessels which could use the harbor.

The commercial statistics for this harbor collected for the calendar year 1901 show that the total amount of freight received and shipped during that period amounted to 1,188,885 tons.

July 1, 1901, balance unexpended	$961.06
Amount appropriated by river and harbor act approved June 13, 1902	125,000.00
	125,961.06
June 30, 1902, amount expended during fiscal year	596.48
July 1, 1902, balance unexpended	125,364.58
July 1, 1902, outstanding liabilities	401.38
July 1, 1902, balance available	124,963.20

(See Appendix P P 4.)

4. Huron Harbor, Ohio.—This harbor is situated within the mouth of the Huron River. In its natural condition the mouth was practically closed by a sand bar.

The first project for its improvement was adopted in 1826, and provided for the construction of two parallel jetties 140 feet apart, extending outward from the river banks. The jetties were extended from time to time and repaired as required, and the channel was finally deepened by dredging.

In 1890 the project was modified to provide for the extension of the jetties out to a depth of 16 feet of water in the lake, and to obtain a similar depth between the piers by dredging.

The total amount expended under all projects for all purposes of construction and maintenance to June 30, 1902, was $193,993.90. It was then estimated that $117,500 would be required to complete the improvement proposed.

In addition to the work done by the United States the Wheeling and Lake Erie Railroad Company, under authority granted by the Secretary of War, has excavated and maintained a channel of 20 feet depth between the jetties and outward to a corresponding depth in the lake.

The present project for the improvement of this harbor is far from satisfactory, but the river and harbor act of June 13, 1902, provides for a survey with a view to securing a channel with a depth of 20 feet. There is no doubt that the harbor is worthy of such improvement, and the resulting survey will furnish a project with estimates of the cost of the work necessary to attain it.

The commercial statistics which have been collected for this harbor show that the receipts and shipments for the calendar year 1901 amounted to 674,492 tons.

At the beginning of the past fiscal year preparations were being made for the complete renewal of 240 linear feet of the west jetty. The work was done during the year by hired labor. The old superstructure was completely removed for the required length and a trench dredged to receive the new cribs. Two cribs, each 120 feet long, were sunk in place and the superstructure was in the course of construction and was nearly finished at the close of the fiscal year.

The Wheeling and Lake Erie Railroad Company during the spring of 1902 has greatly increased its dock facilities and has maintained a depth of 20 feet in the channel.

July 1, 1901, balance unexpended	$24,759.31
Amount appropriated by river and harbor act approved June 13, 1902	40,000.00
	64,759.31
June 30, 1902, amount expended during fiscal year	21,479.50
July 1, 1902, balance unexpended	43,279.81
July 1, 1902, outstanding liabilities	3,762.89
July 1, 1902, balance available	39,516.92

(See Appendix P P 5.)

5. Vermilion Harbor, Ohio.—The last appropriation for this harbor was made June 3, 1896, and the only money available at the beginning of the past fiscal year was $1,323.73, which was the balance of an allotment of $1,500 made by the Secretary of War from the appropriation for "Emergencies in River and Harbor Works," act of June 6, 1900, for repairing the damage done at the shore end of the east jetty by a storm. The break was repaired in the previous year, and the balance was held until April 19, 1902, when it was redeposited to the credit of the appropriation. It is reported that the storm of June 29, 1902, reopened the break.

The river and harbor act of June 13, 1902, requires an examination or survey of this harbor to be made.

(See Appendix P P 6.)

6. Black River (Lorain) Harbor, Ohio.—This harbor is within the mouth of Black River where it enters into Lake Erie 26 miles west of Cleveland. In its natural condition the depth of water at the mouth of this river did not exceed 3 feet, but the river itself was navigable for a distance of 4 miles from its mouth for all vessels then in use upon the lake.

The first project provided for the construction of parallel jetties. These jetties have had to be rebuilt and extended from time to time so as to keep pace with increasing requirements, and dredging has been resorted to to secure a greater depth than the natural currents would afford.

In compliance with the requirements of the river and harbor act of June 3, 1896, a survey of this harbor was made and a new project prepared for its improvement. This project provided for the construction of two breakwaters converging toward the lake, having an opening between them 500 feet in width, in prolongation of the axial line in the jettied channel. It also provided for rebuilding the jetties and for dredging the protected areas to a depth of 20 feet.

The new project was formally adopted by the river and harbor act of March 3, 1899, and provision was made for its execution by a continuous contract. The total amount expended prior to the adoption of the present project was $292,204.77, and the amount expended upon the new project from the time of its adoption to June 30, 1902, was $74,167.26.

For the execution of the new project proposals were invited separately for the dredging and for the construction and repair work. The contract for the dredging was awarded and was duly executed. The lowest bids obtained for the construction and repair work were such as to render it impossible to complete the work within the limit fixed by law.

The act of June 6, 1900, authorized contracts to be entered into for such a portion of the work as the funds available would allow, at a cost not to exceed a 10 per cent increase over the original estimates. Under this authority a contract was made for the construction of all of the proposed works except the east breakwater. This contract was in force at the beginning of the fiscal year.

In the original plan, in order to make use of about 140 linear feet of the existing east jetty, which was then in a comparatively good state of preservation, it was proposed to leave the channel at its original width of 200 feet. As the channel was not straight, this would render it inconvenient and perhaps inadequate; at least such was the opinion

of the vessel interests and of the citizens of Lorain. Accordingly, the plan was changed so as to move the east jetty 100 feet eastward and increase the width of the channel from 200 to 300 feet. A supplementary contract was entered into with the contractor on August 8, 1901, and was approved by the Secretary of War, the funds being sufficient to permit of this alteration of the plan.

At the end of the fiscal year five cribs of an aggregate length of 992 feet had been built and sunk, forming this much of the substructure of the new east jetty. Work was in progress upon four more cribs, sufficient to complete the remaining 768 feet of this jetty. Thirty-six concrete blocks had been molded for the superstructure and some development work had been done by the contractor at his quarry.

In order to complete the east breakwater, an expenditure of about $190,000 in excess of that now provided by law will be necessary.

The commercial statistics for this harbor collected for the calendar year 1901 show that the total amount of freight received and shipped during that period amounted to 1,101,531 tons. Eight vessels were built in this harbor during the year, with an aggregate tonnage of 26,575 tons.

July 1, 1901, balance unexpended	$156,461.93
Amount appropriated by river and harbor act approved June 13, 1902	6,000.00
Amount appropriated by sundry civil act approved June 28, 1902	300,000.00
	462,461.93
June 30, 1902, amount expended during fiscal year	55,629.19
July 1, 1902, balance unexpended	406,832.74
July 1, 1902, outstanding liabilities	3,007.32
July 1, 1902, balance available	403,825.42
July 1, 1902, amount covered by uncompleted contracts	384,679.32
Amount (estimated) required for completion of existing project	230,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	175,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix P P 7.)

7. Cleveland Harbor, Ohio.—The harbor of Cleveland, Ohio, consists of two distinct parts. The main portion, which is used for business purposes, is in the navigable portion of the Cuyahoga River, and a branch known as the "Old River Bed," all inside of the present shore line. All of the channel above the bridge of the Lake Shore and Michigan Southern Railway, which occupies a position practically coincident with the shore line of 1825, has been improved and maintained under the direction of the city authorities.

In 1826, when improvements were first undertaken, the mouth of the river was about 700 feet west of its present location. The plan of improvement contemplated rectifying the channel so that it would lead more directly into the lake, and making the new location permanent by jetties to confine the channel and concentrate the action of the current upon the bar.

The piers were repaired and extended, parts were rebuilt, and the channel was made deeper and maintained by dredging as necessities arose, with no change in the general method of improvement until 1875, at which time the total expenditure had been $346,881.61.

In 1875 a project was adopted for a breakwater in 5 fathoms of water. The west breakwater was commenced in 1876 and completed in 1883, a total length of 7,130 feet. The east breakwater was commenced in 1888 and continued at intervals until 1893, when its length was 2,494.5 feet. In 1895 an opening of 200 feet was made in the shore arm of the west breakwater as a sanitary measure. In 1896 a project for completing certain improvements was approved by Congress and contracts for the work were authorized, at a total cost not to exceed $1,354,000. These improvements embodied in the latest project involve the completion of the east breakwater, covering an extension of about 3,000 feet; removing superstructure of the old west breakwater to a depth of 2 to 3 feet below water level and replacing it with a superstructure of concrete masonry; reenforcing the cribs below the masonry; sheathing the face of east breakwater; removing and rebuilding the east and west piers, and widening the mouth of the river.

The river and harbor act of March 3, 1899, appropriated $75,000 for dredging. A contract for dredging in the harbor to a depth of 21 feet was approved July 7, 1899.

The total of all expenditures for improving Cleveland Harbor from 1825 to June 30, 1902, was $2,679,261.68.

These expenditures covered the cost of construction of the works under the earlier projects and their maintenance up to the time that the project was enlarged, and under the project of 1896 the old superstructure has been removed from the west breakwater over a length of about 3,900 feet, and the concrete has been completed over a length of about 3,800 feet. The remodeling of the jetties at the mouth of the river has been completed and the channel widened and deepened as proposed.

The substructure of the east breakwater has been extended for 2,084 feet and the superstructure built upon all of it but 650 feet, and the greater portion of the outer east harbor has been dredged to a depth of 21 feet.

During the past fiscal year the sum of $210,797.27 has been expended. Most of it has been applied to carrying forward the work under the continuous contracts. The work of rebuilding the superstructure of the west breakwater is now about 83 per cent completed, and the east breakwater has been extended for a total length of 2,736.45 feet.

The river and harbor act of June 6, 1900, required a survey to be made and a plan submitted for providing a safer and better entrance to Cleveland Harbor, and for providing such additional harbor room as might be found necessary by the extension eastward of the breakwater. A survey was made and a plan prepared, which was published on page 3278 of the Annual Report of the Chief of Engineers for 1901. This plan was formally adopted by the river and harbor act of June 13, 1902. The act, however, modifies the plan by requiring the extension of the breakwater to be upon a line in prolongation of the center line of the main portion of the existing breakwater, and that there shall be no further extension of the deflected portion of the east breakwater beyond what has already been constructed. The act appropriates $500,000 for the extension of this work and authorizes, in addition, an expenditure not to exceed $2,300,000 for prosecuting the same. Plans and specifications have been prepared for carrying this law into effect.

The act also appropriates, in addition, the sum of $125,000 for con-

tinuing the improvement of the harbor and for maintenance, and authorizes the payment from this sum of $40,000 toward the purchase of a hydraulic dredge for use in the district.

A comparative survey of the harbor, which was made through the ice during the winter of 1901–2, indicates that the annual deposit of silt in the channel and protected area amounts to nearly 40,000 cubic yards. As the harbor is extended in area this amount will be somewhat, but probably not proportionally, increased. This extensive deposit demonstrates the importance and necessity of having on hand an adequate dredging plant for the maintenance of the required depth.

The freight tonnage of Cleveland Harbor is very great. It amounted to nearly 7,500,000 tons in the calendar year 1901. The statistics show a slight falling off, a little over 1 per cent, from the freight tonnage of the preceding year, but the tonnage of the vessels arriving and departing shows an increase of nearly a million tons. This would indicate that a larger class of vessels is being used and that a greater portion of them are unable to get cargoes to carry away from the harbor.

MAINTENANCE (DREDGING) AND CONTINUING IMPROVEMENT.

Amount appropriated by river and harbor act approved June 13, 1902	$125,000.00
July 1, 1902, balance unexpended	125,000.00

UNDER CONTRACTS, ETC., AUTHORIZED BY ACT OF JUNE 3, 1896.

July 1, 1901, balance unexpended	$279,077.20	
Amount appropriated by sundry civil act approved June 28, 1902	107,000.00	
Repayment of account, damage to piers, April 11, 1902	90.00	
		386,167.20
June 30, 1902, amount expended during fiscal year		210,797.27
July 1, 1902, balance unexpended		175,369.93
July 1, 1902, outstanding liabilities		24,767.73
July 1, 1902, balance available		150,602.20
July 1, 1902, amount covered by uncompleted contracts		116,101.48

NEW ENTRANCE, BREAKWATER EXTENSION, ETC., ACT OF JUNE 13, 1902.

Amount appropriated by river and harbor act approved June 13, 1902	$500,000.00
July 1, 1902, balance unexpended	500,000.00
Amount (estimated) required for completion of existing project	3,981,456.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	350,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix P P 8.)

8. Fairport Harbor, Ohio.—This harbor is situated at the mouth of Grand River, where it enters Lake Erie about 32 miles eastward from the harbor of Cleveland. Before the improvement was undertaken the depth across the bar at the mouth of the river was variable and uncertain and quite insufficient for the needs of commerce.

The first improvement was undertaken in 1825, and the original project provided for the construction of parallel jetties of crib work filled with stone, placed about 200 feet apart and extending outward

across the bar and into the lake. The jetties were extended and have been repeatedly repaired and rebuilt as necessities required, and the channel has been deepened and redredged many times.

In 1896 the project was enlarged to provide for the construction of two breakwaters converging toward the lake, the outer ends being in deep water and sufficient space being left between them to afford an easy entrance to the jettied channel. These breakwaters were to terminate in pierheads 50 feet square, and the total length of the west breakwater was to be 2,050 feet and the east breakwater 1,350 feet. The total amount expended to June 30, 1902, was $498,735.46.

The expenditure has resulted in the construction of a west jetty 2,370 feet in length and the east jetty 1,765 feet in length from the original shore line; also in the construction of 828 linear feet of the shoreward end of the west breakwater. All of these structures are of timber cribs filled with stone and surmounted by continuous timber superstructures. These works have been repaired and maintained, and a large amount of dredging has been done to improve and preserve the channel.

In completing the breakwater it is now proposed to adopt the standard form of stone structure and to use timber cribs only for the substructure of the pierheads. Only $11,544.38 was available for expenditure at the beginning of the past fiscal year, and but little work could therefore be accomplished. The jetties received necessary repairs to the value of $4,416, and in the spring of 1902 the channel, particularly upon the bar, was redredged. Twenty-one thousand five hundred cubic yards of material was excavated, at a cost of $7,350. It was necessary to make an allotment of $1,800 from the appropriation for "Emergencies in River and Harbor Works," act of June 6, 1900, in order to complete the necessary dredging.

The river and harbor act of June 13, 1902, appropriated $200,000 for continuing the improvement and for maintenance. Forty thousand dollars of this amount may be applied to the purchase of a hydraulic dredge, which is greatly needed for annual use at this harbor. The remainder will be applied to rebuilding and repairing the jetties as may be necessary, as these works are absolutely essential to the preservation of the harbor.

The commerce of Fairport amounted to 1,639,746 tons for the calendar year 1901. This is about the same as that reported for the previous year. It is stated that new railroad facilities and extensive dock construction are in contemplation for this harbor, and if carried out will greatly increase its commerce.

July 1, 1901, balance unexpended	$11,554.28
Amount appropriated by river and harbor act approved June 13, 1902	200,000.00
Amount allotted April 15, 1902, from appropriation "Emergencies in River and Harbor Works," act of June 6, 1900	1,800.00
	213,354.28
June 30, 1902, amount expended during fiscal year	13,234.21
July 1, 1902, balance unexpended	200,120.07
July 1, 1902, outstanding liabilities	10.00
July 1, 1902, balance available	200,110.07

(See Appendix P P 9.)

9. Ashtabula Harbor, Ohio.—This harbor is situated at the mouth of the Ashtabula River, where it enters Lake Erie, at a point about 54

miles eastward from the harbor of Cleveland. In its natural condition the mouth of the river was obstructed by a bar upon which the depth of water varied according to the prevailing conditions of storms on the lake and freshets in the river. The greatest possible depth on the bar was 9 feet, this being the distance to the underlying rock near the shore line. The minimum depth probably did not exceed 2 feet.

The original project for improvement of this harbor was adopted in 1826, and provided for the construction of two parallel jetties extending outward from the shore line into the lake. The jetties have been repaired from time to time and extended, and the channel has been deepened by dredging.

In 1891 the depth in the channel was 17 feet, and the project was modified to provide for widening the jettied channel to 213 feet and to extend the jetties to 22 feet depth in the lake, and to dredge between them to a depth of 20 feet.

The river and harbor act of 1896 authorized a new project, which modifies the previous one in regard to the length of the jetties and provides for the construction of two breakwaters converging toward the lake, the outer ends being about 400 feet apart and in water 29 feet deep.

The river and harbor act of March 3, 1899, authorized a continuous contract to be made for the construction of these breakwaters, at a cost not to exceed $430,000.

The total amount expended to June 30, 1902, was $761,271.64.

At that time the channel between the jetties had been widened to 213 feet from a point northward from the Lake Shore Canal and slip, and had been dredged to a depth of 20 feet from the county bridge to deep water in the lake. A section of west breakwater 432 feet in length had been completed. A continuous contract, approved June 22, 1900, had been entered into for the completion of the breakwaters, but up to June 30, 1901, though a considerable amount of preliminary work had been done and the cribs for the substructure of the pierheads had been built, none of the required work was actually in place.

During the present fiscal year the contractor has prepared the foundations for the pierheads and sunk them in place and has completed the concrete superstructure upon one of them. Work is in progress throughout the entire length of the west breakwater between the timber portion already built and the pierhead, but no portion of it has been built up yet to the water surface, the least depth over it being 8½ feet. About 26 per cent of the entire work of the contract has been completed, and satisfactory progress is being made.

In the spring of 1902, at the opening of navigation, the channel was obstructed, as usual, by a bar in advance of the jetties. It was necessary to make an emergency contract for the removal of this bar. This was done and the channel restored, 11,780 cubic yards of sand and clay having been excavated.

The outer end of the west jetty, which had given a great deal of trouble in the past, was repaired with concrete in sacks in the fall of 1901. On June 22, 1902, the end of this jetty was struck by a heavily loaded steamer and 18 or 20 feet of the structure was practically demolished. The proper repair will probably require the removal and the rebuilding of about 40 feet of the jetty.

The river and harbor act of June 13, 1902, appropriated $200,000 for continuing the improvement and maintenance of this harbor.

Twenty thousand dollars of this amount may be applied to the purchase of a hydraulic dredge. The remainder will probably be sufficient to put the jetties in a satisfactory condition.

The commerce of Ashtabula Harbor is very great. For the calendar year 1901 it exceeded 6,000,000 tons, which was an increase of 248,000 tons over that of the previous year, and was the greatest ever reported.

July 1, 1901, balance unexpended		$154,441.89
Amount appropriated by river and harbor act approved June 13, 1902		200,000.00
Amount appropriated by sundry civil act approved June 28, 1902		200,000.00
		554,441.89
June 30, 1902, amount expended during fiscal year	$85,312.32	
June 19, 1902, amount redeposited	141.55	
		85,453.87
July 1, 1902, balance unexpended		468,988.02
July 1, 1902, outstanding liabilities		24,116.00
July 1, 1902, balance available		444,872.02
July 1, 1902, amount covered by uncompleted contracts		323,901.57
Amount (estimated) required for completion of existing project		118,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902		118,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

(See Appendix P P 10.)

10. Conneaut Harbor, Ohio.—This is the most easterly harbor comprised in the Cleveland district. It is at the mouth of Conneaut Creek in the northeastern part of the State of Ohio. It is about 67 miles eastward from the harbor of Cleveland, and westward about 28 miles from the harbor of Erie, Pa. In its natural condition the creek was obstructed by a bar at its mouth, over which the average depth of water did not exceed 2 feet.

The first improvement was undertaken in 1829, and consisted in the construction of parallel jetties of timber and stone extending outward into the lake so as to prolong the natural banks of the river and to confine the current and cause it to wash away the bar.

From 1829 until 1880 there was expended in the construction and maintenance of these works the sum of $112,629.39. No appropriation was made for the harbor from 1880 until 1892.

At that time the jetties were in a decayed and ruinous condition, and the channel had been filled up with sand and silt, and was too shallow to be used by any vessel larger than the small sailing craft used for fishing.

A new project was approved in 1892, and provided for the construction of parallel jetties 200 feet apart and of sufficient length to extend outward to a depth of 17 feet in the lake. The project was further modified in 1896 to provide for the construction of two breakwaters converging toward the lake in such a manner as to shelter the entrance into the jettied channel, and possibly to prevent the formation of the bar of sand which the seas were constantly building across it. The project also contemplated a small extension to the east jetty and dredging of the protected areas to a depth of 20 feet.

The estimate of cost of the new project, exclusive of maintenance, was $610,000, and the amount expended in furtherance of it, to June 30, 1902, was $223,254.79. This sufficed for the construction of 1,027

linear feet of the west breakwater and for the removal of such stone in the channel as it was necessary for the United States to remove. A great deal of temporary dredging has also been done for the purpose of maintaining the depth called for by the project.

The river and harbor act of June 13, 1902, provides as follows:

Improving Conneaut Harbor, Ohio: Continuing improvement and for maintenance, two hundred thousand dollars: *Provided*, That a contract or contracts may be entered into by the Secretary of War for such materials and work as may be necessary for the prosecution of the approved project, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate two hundred and fifty thousand dollars, exclusive of the amounts herein and heretofore appropriated.

In addition to the construction of the new works described in the project of 1896, it will be necessary in the way of maintenance, and in order to make the entire improvement of a permanent character, to replace 512 linear feet of sheet-piling work at the shoreward end of the east jetty by a permanent crib structure with a concrete top; and also to replace the old timber superstructure on 1,006 linear feet of existing jetty by a concrete top of standard design. It is thought that the expenditure of the funds authorized by the act above quoted will be sufficient for all of this work, and also for the maintenance of the channel while the work is under construction.

At the beginning of the fiscal year a contract was in force for continuing the construction of a portion of the west breakwater. The length to be built was 744½ feet, and the contract was completed early in October.

In the Spring of 1902 it was found that a bar had formed across the channel beyond the end of the jetties of sufficient magnitude to obstruct navigation. An emergency contract for dredging through the bar was let, and the bar was removed during the month of April, the total amount of material dredged being 10,420 cubic yards.

The commerce at Conneaut continues to exhibit very satisfactory growth. In 1893 it amounted to nothing. In 1901 it was nearly 4,000,000 tons, being an increase of 622,000 tons over that of the preceding fiscal year.

July 1, 1901, balance unexpended		$53,215.49
Amount appropriated by river and harbor act approved June 13, 1902		200,000.00
		253,215.49
June 30, 1902, amount expended during fiscal year	$50,970.28	
June 19, 1902, amount redeposited	431.80	
		51,402.08
July 1, 1902, balance unexpended		201,813.41
July 1, 1902, outstanding liabilities		8.09
July 1, 1902, balance available		201,805.32
Amount (estimated) required for completion of existing project		250,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902		100,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix P P 11.)

11. Removing sunken vessels or craft obstructing or endangering navigation.—One wreck (schooner *M. P. Barkalow*) was removed from Lake Erie not far from Put in Bay. Reported obstructions near Ashtabula and Monroe were looked for but not found. The cost of the work under the permanent-indefinite appropriation was $933.82. The

expense of the work near Monroe, amounting to $578.28, was defrayed from appropriation for survey of Northern and Northwestern Lakes.

(See Appendix P P 12.)

IMPROVEMENT OF ERIE HARBOR, PENNSYLVANIA, AND OF CERTAIN RIVERS AND HARBORS IN WESTERN NEW YORK.

This district was in the charge of Maj. T. W. Symons, Corps of Engineers. Division Engineer, Col. Chas. R. Suter, Corps of Engineers, to July 24, 1901, and Col. S. M. Mansfield, Corps of Engineers, since that date.

1. Harbor at Erie, Pa.—In its original condition the harbor of Erie was landlocked, the only entrance being to the east. The channel was narrow and tortuous, variable in position, with a depth of about 6 feet.

The original project, approved March 26, 1824, provided for closing the eastern end of the harbor by means of a breakwater in which there should be an opening 200 feet wide, and for extending to deep water in the lake two parallel piers, one on each side of the opening. The project also includes the necessary work of dredging to keep the channel open, making the necessary repairs to existing structures, and maintaining Presque Isle Peninsula.

This project was modified by the river and harbor act of March 3, 1899, and now requires the harbor and entrance to be dredged to a depth of 20 feet, the north and south piers to be extended 500 and 1,000 feet, respectively, and four protection jetties to be built along the outer edge of Presque Isle Peninsula.

The estimated cost of completing the modified project was $377,000.

At the close of the past fiscal year 1,210 feet of wooden superstructure on north pier had been replaced with concrete, the pier had been extended 510 feet, one protection jetty had been built, the channel dredged 20 feet deep, and the basin partly dredged.

The total amount expended on the harbor to June 30, 1902, was $1,052,725.61. It is impracticable to separate the cost of construction and maintenance.

The maximum draft that could be carried June 30, 1902, at mean low water over the shoalest part of the locality under improvement was 18½ feet, and the usual variation of level of water surface is about 2 feet.

The following table gives the total arrivals and departures, including tonnage, for the past ten years, as compiled from Annual Reports of the Chief of Engineers.

Year.	Number.	Tonnage.	Year.	Number.	Tonnage.
1892	2,180	2,409,945	1897	3,133	4,051,984
1893	1,677	1,701,542	1898	2,939	3,939,019
1894	2,687	3,069,545	1899	3,200	3,961,794
1895	2,936	3,323,672	1900	2,709	3,403,312
1896	3,100	3,323,672	1901	3,405	3,204,325

Work proposed for the next fiscal year, necessary to make the improvement available, includes replacing about 1,200 feet of old timber superstructure on the south pier with concrete, building one, and perhaps two, protection jetties, riprapping the north pier, maintaining structures and entrance channel, and dredging the area at eastern end of the bay, if funds now on hand will allow.

For more extended information and sketches see Annual Report of the Chief of Engineers for 1900, page 4108 et seq.

July 1, 1901, balance unexpended	$19,610.87
Amount appropriated by river and harbor act approved June 13, 1902	125,000.00
	144,610.87
June 30, 1902, amount expended during fiscal year	752.36
July 1, 1902, balance unexpended	143,858.51

(See Appendix Q Q 1.)

2. Harbor at Dunkirk, N. Y.—The harbor at Dunkirk is naturally a simple indentation of the south shore of Lake Erie. It lies between Point Gratiot on the west and Battery Point on the east. Between the two points is a distance of 9,600 feet, and the maximum breadth of the bay behind the line of the two headlands is 3,600 feet. The general depth of water in the bay was about 10 feet. The bay is underlaid with rock at an average depth of 15 to 16 feet. The object of the improvement is to form an artificially protected harbor in this indentation or bay.

The existing project, approved November 30, 1870, provides for a detached breakwater 2,860 feet long, one part of which, 2,300 feet long, was to be nearly parallel with the shore; the other part, 560 feet long, to be nearly parallel with the axis of the channel entrance.

This breakwater and the pier already built were to form the harbor, and the old channel was to be enlarged to 170 feet wide and 13 feet deep.

All the works now existent at Dunkirk have been built according to this plan. The project adopted by Congress and provided for by the river and harbor act of June 3, 1896, consisted in completing the breakwater as before planned by the addition of 360 feet to its eastern end and adding the channel arm, 560 feet long, and in addition thereto dredging an entrance channel and a harbor basin, containing in all about 65 acres, to a depth at mean lake level suitable for vessels drawing 16 feet. This work was completed in 1898 at a total cost of $389,060.55.

The total amount expended on the harbor to June, 1902, was $960,967.02.

It is impracticable to separate the cost of construction and maintenance. No work was done during the fiscal year ending June 30, 1902.

The old timber breakwater and pier need repair, to provide for which $25,000 has been appropriated.

The maximum draft that could be carried June 30, 1902, at mean low water over the shoalest part of the locality under improvement was 16 feet, and the usual variation of level of water surface is about 2 feet.

The following table gives the total arrivals and departures, including tonnage, for the past ten years, as compiled from the Annual Reports of the Chief of Engineers:

Year.	Number.	Tonnage.	Year.	Number.	Tonnage.
1892	58	13,756	1897	197	12,160
1893	137	19,158	1898	180	22,005
1894	76	18,763	1899	192	82,783
1895	69	15,650	1900	278	107,316
1896	42	12,160	1901	171	49,148

Work proposed for the next fiscal year, necessary to make the improvement available, consists in putting the breakwater and pier in *thorough* repair, for which funds are now on hand.

For more extended information and map see Annual Report of the Chief of Engineers for 1898, page 2748 et seq.

July 1, 1901, balance unexpended	$1,370.61
Amount appropriated by river and harbor act approved June 13, 1902	25,000.00
Repaid to appropriation	250.00
	26,620.61
June 30, 1902, amount expended during fiscal year	.25
July 1, 1902, balance unexpended	26,620.36

(See Appendix Q Q 2.)

3. Harbor at Buffalo, N. Y.—Buffalo Creek was the original harbor of the port of Buffalo. In its original condition it was shallow and closed by a gravel bar for most of the year. The original project for the improvement of this harbor was adopted in 1826, and provided at first for the construction of piers on the north and south sides of Buffalo Creek. Subsequently a masonry sea wall, running north from the south shore of the south pier, was proposed and built. In 1868 a detached breakwater, about 2,500 feet lakeward from the lighthouse, to extend south a distance of 4,000 feet, was proposed and adopted. In 1874 it was determined to extend this breakwater to a total length of 7,600 feet. This breakwater has now its full proposed length, the final extension of 806 feet having been built in 1893. It runs parallel with the shore and about half a mile distant from it. In 1874 it was also proposed to build a shore arm to the breakwater, the inshore end to consist of pile work near shore and crib work in deeper water. Upon reaching the 16-foot contour line in the lake this shore arm was planned to continue in a direction making an angle of 45 degrees with the shore and to overlap the south end of the breakwater, leaving an opening of 150 feet. In 1886 a project was approved for replacing with concrete the wooden superstructure as soon as it became badly decayed. To date 4,894.13 feet has been so replaced.

In 1895 a new project was adopted for the improvement of Buffalo Harbor. The project consists of the abandonment of the shore arm and the extension of the breakwater from its present southern end to Stony Point. The report of the Board and details of its plans are published in the Annual Report of the Chief of Engineers for 1895, page 3153 et seq. The river and harbor act of June 3, 1896, added to the project of the Board of Engineers by providing for the construction of a further length of the sand-catch pier, extending it to the established pierhead line.

The project now in force for the improvement of Buffalo Harbor is:

(*a*) To maintain existing structures, making the requisite minor repairs, and replacing the wooden superstructure of the breakwater with concrete when necessary.

(*b*) To build an extension of the breakwater from its present southern end to Stony Point, leaving the necessary openings for the convenience of commerce.

(*c*) To extend the sand-catch pier to the established pierhead line.

A new concrete superstructure was placed on 1,400 feet of the south pier during the last season under contract with the Buffalo Dredging Company.

About 1,800 feet of timber crib superstructure on the south harbor section of the breakwater has been replaced with concrete superstructure, having been wrecked by the severe storms of last fall. A con-

tract was made for the work April 10, 1901, and the work was finished May 18, 1902.

The total amount expended by the United States on the improvement of Buffalo Harbor to June 30, 1902, was $4,549,819.08. It is impracticable to separate the cost of construction and maintenance.

A very good harbor has been obtained. The principal features are north and south piers at the mouth of Buffalo Creek, in which most of the business of the port is done; also an outer breakwater, 7,608.6 feet long, built of timber and stone; the new north breakwater, 2,200 feet long, and the main breakwater extension now under way.

A sea wall 5,400 feet long was built along the lake shore south of the harbor entrance, and a sand-catch pier of piles and stone 1,147 feet long built out from the shore.

The maximum draft that could be carried June 30, 1902, at mean low water over the shoalest part of the locality under improvement was 20 feet, and the usual variation of level of water surface is from 3 to 4 feet, with maximum variation much greater.

The commerce of Buffalo is enormous. During the year arrivals and departures of vessels by lake and river aggregated in number 11,599, and in tonnage 10,454,680.

The arrivals and departures of canal boats by the Erie Canal were 6,812. The principal receipts by lake and river were wheat, corn, flour, oats, iron ore, lumber, copper, pig iron, glucose, lard, and pork. The total receipts amounted to 6,619,390 tons.

The shipments by lake were principally coal, sugar, salt, and cement, and aggregated 3,600,319 tons.

For comparison, the following table is given, showing arrivals and departures by lake and canal and the tonnage for the past five years:

Year.	Lake.		Canal.	
	Number.	Tonnage.	Number.	Tonnage.
1897	10,778	11,299,091	9,218	1,207,964
1898	10,708	12,040,993	8,338	1,115,407
1899	10,417	10,481,043	7,506	1,033,170
1900	9,973	10,216,407	6,842	888,318
1901	11,599	10,454,680	6,812	1,653,334

	Arrivals and departures.		Receipts of freight.		Shipments of freight.	
	1900.	1901.	1900.	1901.	1900.	1901.
Lake and river	9,973	11,599	7,425,874	6,619,390	2,790,533	3,600,319
Canal	6,842	6,812	365,725	340,234	522,593	1,313,100
Total	16,815	18,411	7,791,599	6,959,624	3,313,126	10,913,419

Total shipments and receipts, 1900, 11,104,727 tons; 1901, 17,873,043 tons.

Work proposed for the next fiscal year with funds now on hand and which is necessary to make the improvement available and to extend its benefits is as follows:

First. To finish the extension of the breakwater south to Stony Point.

Second. To repair and maintain existing structures.

Third. To remove the rock shoal in the entrance channel below the junction of Buffalo River and the City Ship Canal, and maintain channels.

For more extended information and map see Annual Report of the *Chief of Engineers* for 1898, page 2756 et seq.

July 1, 1901, balance unexpended	$760,398.71
Amount appropriated by river and harbor act approved June 13, 1902	30,000.00
Amount appropriated by sundry civil act approved June 28, 1902	200,000.00
	990,398.71
June 30, 1902, amount expended during fiscal year	540,728.42
July 1, 1902, balance unexpended	449,670.29
July 1, 1902, amount covered by uncompleted contracts	408,538.27

(See Appendix Q Q 3.)

4. Lake Erie entrance to Black Rock Harbor and Erie Basin, New York.—This is a new work, the adopted project contemplating the formation, by dredging and rock removal, of a channel 3,300 feet long, 400 feet wide, and 23 feet deep at mean lake level, except where bed rock is found at a depth of 22 feet, from Buffalo main entrance channel to Erie Basin, and a branch channel and basin 1,920 feet long, 500 feet wide, and 23 feet deep at mean lake level to Black Rock Harbor, at an estimated cost of $814,643. The act of June 13, 1902, authorizes the letting of a continuing contract in the sum of $614,643, exclusive of amount appropriated, for completing the work.

The plan of improvement is printed in House Doc. No. 125, Fifty-sixth Congress, second session, and in the Annual Report of the Chief of Engineers for 1901, page 3345.

There were no operations during the past year.

Amount appropriated by river and harbor act approved June 30, 1902	$200,000.00
July 1, 1902, balance unexpended	200,000.00
Amount (estimated) required for completion of existing project	614,643.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	250,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

5. Buffalo entrance to Erie Basin and Black Rock Harbor, New York.—The first appropriation, $50,000, for this improvement was made March 3, 1899, and an appropriation of $191,701.25 was made June 6, 1900, to complete the work.

The adopted project is to build a breakwater about 2,200 feet long, covering and protecting the entrance to Erie Basin and Black Rock Harbor and the lake front of Buffalo Harbor between the State structures known as the Erie Basin breakwater and the Bird Island pier.

The project has been completed.

The amount expended to June 30, 1902, was $238,436.81, of which $236,278.10 was for construction and $2,158.71 was for maintenance.

The maximum draft that could be carried over the shoalest part of the locality under improvement at mean low water June 30, 1902, was 17 feet, and the usual variation of level of water surface is from 3 to 4 feet, with maximum variation much greater.

For commercial statistics see report on Buffalo Harbor.

For more extended information see Annual Report of the Chief of Engineers for 1897, page 3246 et seq.

July 1, 1901, balance unexpended	$5,423.15
June 30, 1902, amount expended during fiscal year	2,158.71
July 1, 1902, balance unexpended	3,264.44

(See Appendix Q Q 4.)

6. Tonawanda Harbor and Niagara River, New York.—In its original condition the navigation of Niagara River from Lake Erie to Tonawanda was obstructed by several reefs and shoals, which materially limited the draft of vessels traversing it. The water in the harbor between Tonawanda Island and the mainland was shoal, and the river in some places had a very swift current.

The object of the project undertaken is to provide a navigable channel from the head of Niagara River at Lake Erie to the north line of the village of North Tonawanda and to dredge Tonawanda Harbor to a depth permitting its use by vessels of 16 feet draft.

The adopted project of April 11, 1888, is to remove obstructions so as to make a channel 400 feet wide and 18 feet deep, which includes work at the following places:

(*a*) On the Horseshoe Reef, at the entrance to Niagara River.

(*b*) On the shoal at the head of Strawberry Island.

(*c*) At a few shoal places abreast of the lower end of Rattlesnake Island.

(*d*) The full width of the river between Tonawanda Island and the mainland along the entire front of Tonawanda.

The cost of the work, estimated in 1891, was $1,152,987.93. This does not include the work necessary between Tonawanda Island and the north line of the village of North Tonawanda. The amount expended on the general project up to June 30, 1902, was $423,292.99, all for excavation.

At this time the channel through the Horseshoe Reef and the channel through the reef at Strawberry Island had been completed to a depth of 18 feet and width of 400 feet. No change in depth was made during the past year.

Tonawanda Harbor has been dredged 20 feet wide to a depth of 18 feet along nearly all the length of Tonawanda Island and mainland front, and a shoal at the foot of Tonawanda Island removed.

The commerce of Tonawanda is large. During the year 1901 there were entered and cleared 1,979 lake craft, with a tonnage of 1,076,365 tons. The receipts were principally lumber, iron ore, and limestone, and aggregated 1,080,304 tons. The shipments from Tonawanda amount to very little.

The maximum draft that could be carried June 30, 1902, at mean low water over the shoalest part of the locality under improvement was 15 feet, and the usual variation of level of water surface is 2 feet.

Work proposed for the next year necessary to make the improvement available includes the dredging of Tonawanda Harbor and dredging in Niagara River on the shoal at the head of Strawberry Island and at such other places as may be found necessary to complete the channel of the project.

For more extended information see Annual Report of the Chief of Engineers for 1900, page 4139.

July 1, 1901, balance unexpended	$1,714.71
Amount appropriated by river and harbor act approved June 13, 1902	257,700.00
	259,414.71
June 30, 1902, amount expended during fiscal year	7.70
July 1, 1902, balance unexpended	259,407.01

(See Appendix Q Q 5.)

7. Niagara River from Tonawanda to Port Day, N. Y.—Port Day is the inlet to the old hydraulic power canal at Niagara Falls. It is not and never has been a practicable port of commerce, owing to its shallow water and its proximity to the head of Niagara Falls.

From Port Day up, the river in front of Niagara Falls is very shallow and with rock bed until Conners Island is reached. Between Conners Island and the main shore is a snug little harbor of about 5 acres, with a depth of 12 feet at mean river stage and with a maximum depth of about 18 feet.

By act of Congress of August 18, 1894, provision was made for improving Niagara River from Tonawanda to Port Day, with a view to obtaining a channel of 12 feet depth to Schlosser's dock.

The project as it now stands is therefore to provide a channel 12 feet in depth at low water and 200 feet in width from Schlosser's dock, back of Conners Island, through to Tonawanda by the American channel of the Niagara River. This project is recognized by the river and harbor act of June 3, 1896. The total cost of the work contemplated by the project is $95,000.

Up to June 30, 1902, there had been expended on the project $60,000, all for excavation. A channel of 12 feet depth at mean river level and 200 feet wide has been completed the entire length of the Conners Island shoal, about 1,700 feet, and a channel 12 feet deep and 150 to 170 feet wide through the Cayuga Island shoal. No work has been done during the past year.

The commerce involved in the improvement is very small. During the year the total arrivals and departures were 106, most of which were small excursion boats. Whatever benefit the work confers will be upon future commerce.

The maximum draft that could be carried June 30, 1901, at mean low water over the shoalest part of the locality under improvement was 12 feet, and the usual variation of level of water surface is 2 feet.

No work is proposed for the next fiscal year, as no appropriation for this work was made in the last river and harbor act.

For more extended information see Annual Report of the Chief of Engineers for 1900, page 4144 et seq.

July 1, 1901, balance unexpended	$358.49
June 30, 1902, amount expended during fiscal year	358.49

(See Appendix Q Q 6.)

IMPROVEMENT OF HARBORS ON LAKE ONTARIO AND OF ST. LAWRENCE RIVER AND HARBORS THEREON, NEW YORK.

This district was in the temporary charge of Maj. T. W. Symons, Corps of Engineers. Division Engineer, Col. Chas. R. Suter, Corps of Engineers, to July 24, 1901, and Col. S. M. Mansfield, Corps of Engineers, since that date.

1. Harbors at Wilson and Oak Orchard, N. Y.—*(a) Wilson Harbor.*—This harbor is at the mouth of Twelve-mile Creek. In its original condition there was a depth on the bar of 1 foot. In 1846 two piers were built by private enterprise about 400 feet into the lake.

The original project of 1873 for improvement by the General Government was to extend the piers to the 12 foot-curve in Lake Ontario and to dredge a channel 12 feet deep between the piers and to deep water in the creek, at an estimated cost of $90,000, increased in 1877

to $100,000. January 10, 1900, the project was modified to obtain and maintain a depth of 10 feet at extreme low water without further extension of the piers, at least for the present.

The amount expended to June 30, 1902, was $72,500.50, of which $15,113.05 was applied to maintenance of improvement.

At that date there was a minimum of 9 feet below extreme low water, but the channel is not stable, and fills rapidly with sand driven by storms.

During the fiscal year ending June 30, 1901, the most necessary repairs were made to the decks of both piers and 44 linear feet of Wakefield sheet piling was driven to close a hole under two cribs in the west pier.

The maximum draft that could be carried into this harbor at mean low water June 30, 1902, was 8 feet, and the usual variation of level of water surface is 3 feet.

The following is a statement of the commerce of this port for the years given:

	Tons.		Tons.
1891	1,296½	1900	653
1898	294½	1901	312
1899	124		

For more extended information and sketch see Annual Report of the Chief of Engineers for 1889, page 2395 et seq.

(*b*) *Oak Orchard Harbor.*—This harbor is at the mouth of Oak Orchard Creek, and in its original condition had about 3 feet of water on the bar.

The original project, adopted in 1836, was to narrow the mouth of the creek to 200 feet by two breakwaters running from the shore, and to make a 12-foot channel between parallel piers from deep water in the creek to the 12-foot curve in the lake.

The piers were built west 1,142 feet long, east 911 feet long, and a shore protection added, extending 9 feet easterly from the shore end of the east pier.

These piers are now decayed, and the channel fills in rapidly with sand. No work has been done on this harbor for several years, no funds being available.

The amount expended to June 30, 1902, was $205,000. The cost of construction and maintenance can not be separated.

The maximum depth that could be carried June 30, 1902, over the shoalest part of the improvement was 6 feet, and the usual variation of level of water surface is 3 feet.

The commerce of Oak Orchard is insignificant, being mostly excursion and summer-resort business.

For more extended information and sketch see Annual Report of the Chief of Engineers for 1879, page 1727.

Amount appropriated by river and harbor act approved June 13, 1902.... $4,500.00
July 1, 1902, balance unexpended 4,500.00

(See Appendixes R R 1 and 2.)

2. Harbor at Olcott, N. Y.—This harbor is at the mouth of Eighteen-mile Creek. In its original condition there was a depth of 3 feet on the bar.

The original project, adopted in 1867, provided for a channel 11 feet deep and 150 feet wide between parallel piers about 200 feet apart.

The piers were built, east pier 850 feet and west pier 873 feet long, and the channel dredged 11 feet deep. In 1891 a new project was adopted calling for a depth of 13½ feet from the Main Street Bridge to deep water in the lake, but no work has been done.

The piers are decayed, and the channel has filled in with sand, so there is now a depth of barely 7½ feet.

The amount expended to June 30, 1902, was $163,000. It is impracticable to separate the cost of construction and maintenance.

The maximum draft that could be carried June 30, 1902, over the shoalest part of the improvement was 6½ feet. The usual variation of level of water surface is 3 feet.

The commerce of Olcott is small, but increasing, and new lines are being established which will make it a port of considerable importance.

For more extended information and map see Annual Report of the Chief of Engineers for 1891, page 2893 et seq.

Amount appropriated by river and harbor act approved June 13, 1902... $15,000.00
July 1, 1902, balance unexpended..... 15,000.00

(See Appendix R R 3.)

3. Harbor at Charlotte, N. Y.—This harbor is at the mouth of the Genesee River. In its original condition vessels could carry only 8 feet across the bar.

The original project of 1829 was to scour a channel 12 feet deep across the bar by constructing parallel piers to confine and direct the action of spring freshets. The present project of 1882 is to obtain a depth of 15 feet by extending the two piers a total of 3,250 feet and by dredging. (See Annual Report of the Chief of Engineers for 1881, p. 2457.) After the piers had been extended 1,444 feet the project was modified July 18, 1896, to preserve the depth by dredging without further extension of the piers for the present, and March 2, 1897, it was again modified to obtain and maintain not less than 16 feet and not more than 16½ feet at extreme low water.

The amount expended to June 30, 1902, was $531,803.89. It is impracticable to separate the cost of construction and maintenance.

June 30, 1902, the minimum depth that could be carried at mean low water was 15 feet, and the usual variation of level of water surface is 3 feet.

The following is a statement of the commerce at this port during the past ten years:

	Tons.		Tons.
1892	460,956	1897	385,981
1893	347,288	1898	483,850
1894	400,492	1899	447,428
1895	369,417	1900	399,605
1896	444,557	1901	549,207

Work proposed for the next fiscal year, to make the improvement available, is to make necessary repairs to piers, to dredge the channel, and to carry out the modified project adopted in the river and harbor act of June 13, 1902, by narrowing the entrance channel to 200 feet by means of 3,600 linear feet of brush mattress and stone laid lengthwise of the channel.

For more extended information and map see Annual Report of the Chief of Engineers for 1881, page 2436.

July 1, 1901, balance unexpended	$1,948.63
Amount appropriated by river and harbor act approved June 13, 1902	30,000.00
	31,948.63
June 30, 1902, amount expended during fiscal year	1,924.12
July 1, 1902, balance unexpended	30,024.51

(See Appendix R R 4.)

4. Harbor at Great Sodus Bay, New York.—In its original condition the channel connecting this bay with Lake Ontario was wide and impracticable for vessels drawing over 8 feet.

The original project of 1829 was to narrow the entrance by constructing two converging breakwaters and deepen it to 12 feet by building two parallel piers and by dredging. The present project of 1882 is to obtain a depth of 15 feet at low water by extending the two piers a total of 1,100 feet and by dredging. After the piers had been extended 519 feet the project was modified July 18, 1896, to restore and maintain the requisite depth of 15 feet by dredging, without further extension of the piers for the present.

The amount expended to June 30, 1902, was $489,587.60, of which $81,335.80 was for maintenance.

The minimum depth now is 13 feet below extreme low water in a channel width of 60 feet, and the usual variation of level of water surface is 3 feet.

The following is a statement of commerce at this port for the past ten years:

	Tons.		Tons.
1892	62,276	1897	36,361
1893	14,277	1898	79,709
1894	77,471	1899	78,885
1895	43,566	1900	84,379
1896	36,361	1901	57,730

Work proposed for the next fiscal year, necessary to make improvement available, is to dredge and make necessary repairs to the piers.

For more extended information and map see Annual Report of the Chief of Engineers for 1881, page 2441 et seq.

July 1, 1901, balance unexpended	$3,011.96
Amount appropriated by river and harbor act approved June 13, 1902	5,000.00
	8,011.96
June 30, 1902, amount expended during fiscal year	2,951.76
July 1, 1902, balance unexpended	5,060.20

(See Appendix R R 5.)

5. Harbor at Little Sodus Bay, New York.—In its original condition the channel connecting this bay with Lake Ontario was about 150 feet wide and 18 inches deep.

The original project of 1854 was to deepen the channel by building two parallel piers across the bar to the 15-foot curve in the lake and to connect them with the shore by riprap. In 1867 this project was modified to provide for dredging the depth of 12 feet. The present project of 1882 is to obtain a depth of 15 feet by extending the piers to the 15-foot curve in the lake and by dredging. After the piers had been extended 835 feet the project was modified June 29, 1898, to restore and maintain the requisite depth of 15 feet by dredging, without further exten-

sion of the piers for the present, and this was modified by the river and harbor act of June 13, 1902, to extend the east pier 300 feet.

The amount expended to June 30, 1902, was $338,269.57, of which $57,821.31 was applied to maintenance of improvement.

At that date there was a depth in the channel between the piers of 13 feet at extreme low water in a channel width of 100 feet.

The maximum draft that could be carried over the shoalest part of the locality under improvement June 30, 1902, was 12 feet.

The usual variation of level of water surface is 3 feet.

The following is a statement of commerce at this port for ten years:

	Tons.		Tons.
1891	134,241	1896	65,418
1892	101,324	1897	68,888
1893	66,345	1898	50,339
1894	63,595	1899	81,969
1895	63,708	1901	135,118.6

Work proposed for the next fiscal year, necessary to make the improvement available, consists in extending the east pier 300 feet and maintenance of channel and piers.

For more extended information and map see Annual Report of the Chief of Engineers for 1881, page 2443 et seq.

July 1, 1901, balance unexpended	$1,074.08
Amount appropriated by river and harbor act approved June 13, 1902	25,000.00
	26,074.08
June 30, 1902, amount expended during fiscal year	900.88
July 1, 1902, balance unexpended	25,173.20

(See Appendix R R 6.)

6. Harbor at Oswego, N. Y.—This harbor comprises the lower part of the Oswego River and an outer cove. In its original condition the inner part was navigable by vessels of light draft only, and the outer part had no protection against the seas.

The original project of 1827 (completed in 1829) was to build across the cove a breakwater of timber cribs filled with stone. Between 1830 and 1838 a superstructure of masonry was built on 500 feet of the breakwater. Between 1866 and 1869 $41,000 was expended in dredging the harbor to the depth of 12 feet at extreme low water. Between 1868 and 1870 the light-house pier was extended north 437 feet. In 1881 an outer breakwater was completed, having a lake face 4,870 feet long, a westerly shore return 916 feet long, and an easterly return 246 feet long. In 1881 a project was adopted to build an east breakwater, 248 feet of which was constructed in 1881 and removed in 1889. In 1885 and 1889 two spurs to the outer breakwater, 100 and 150 feet long, respectively, were completed. In 1893 (sundry civil act of March 3) the excavation of rock in the river was added to the project.

The present project of 1896, as subsequently modified, is: First, to build an east breakwater 1,435 feet long, at an estimated cost of $197,000 (acts of March 3, 1895, and June 3, 1896); second, to narrow the breach made in the outer breakwater in 1884 from 175 to about 75 feet, at an estimated cost of $18,500 (June 20, 1896); third, to carry the rock excavation in the Oswego River farther upstream (March 3, 1897); fourth, to remove part of the island between Schuyler and Van Buren streets to a depth of 15 feet; also to excavate rock and dredge to a small extent between the island and the west bank, at an estimated cost of $12,000 (March 6, 1897, and act of March 3, 1899).

The amount expended to June 30, 1902, was $1,971,506.97. It is impracticable to separate the cost of construction and maintenance.

At that date there were 5,857 feet of outer breakwater and 1,963 feet of inner breakwater, forming an outer harbor containing 38.9 acres and an inner harbor containing 9.35 acres (including the Oswego River), both having a controlling depth of 14.5 feet at extreme low water.

The outer breakwater is in bad condition, and the river and harbor act of June 13, 1902, provides for a survey to determine what repairs are necessary and advisable.

During the fiscal year ending June 30, 1902, the outer breakwater was repaired as much as possible with the funds allotted from the emergency appropriation of June 6, 1900. The inner breakwater was repaired where absolutely necessary, and the removal of the "upper island" in the Oswego River was completed.

June 30, 1902, the maximum draft that could be carried at extreme low water over the shoalest part of the locality under improvement was 14 feet.

The usual variation of level of water surface is 3 feet.

The following is a statement of the commerce of this harbor for the last ten years:

	Tons.		Tons.
1892	964,240	1897	706,805
1893	947,688	1898	615,503
1894	829,469	1899	716,753
1895	749,575	1900	575,160
1896	783,972	1901	565,052

Work proposed for the next fiscal year necessary to make the improvement available consists in rock excavation in the river, and necessary repairs to protect the breakwater, pending a survey to determine its needs.

For more extended information and map see Annual Report of the Chief of Engineers for 1881, pages 2451 et seq.

July 1, 1901, balance unexpended	$10,889.25
Amount appropriated by river and harbor act approved June 13, 1902	51,000.00
	61,889.25
June 30, 1902, amount expended during fiscal year	9,783.35
July 1, 1902, balance unexpended	52,105.90

(See Appendix R R 7.)

7. *Harbor at Cape Vincent, New York.*—This harbor is an open roadstead on the St. Lawrence River, 2½ miles from Lake Ontario, and is a convenient location for vessels to lie during storms at night and in thick weather.

The original project of 1896 was to build a breakwater parallel to and 600 feet from the railroad wharf, 1,600 feet long, at an estimated cost of $320,000. On May 13, 1899, this project was modified to build a breakwater parallel to and 500 feet from the railroad wharf, 1,500 feet long, at an estimated cost of $200,000. Four hundred and ten feet of this breakwater was built in 1900, leaving 1,090 feet yet to be built.

The amount expended to June 30, 1902, was $48,963.99, all for construction.

The maximum draft that could be carried over the locality under

improvement at mean low water June 30, 1902, was 19 feet, and the usual variation of level of water surface is 3 feet.

The commerce of Cape Vincent is not large. This improvement is intended to make a harbor of refuge for all craft plying between Lake Ontario and the St. Lawrence River.

Work proposed for the next fiscal year necessary to make the improvement available is to continue the extension of the breakwater as far as the funds available will permit.

For more extended information and map see Annual Report of the Chief of Engineers for 1897, pages 3286 et seq.

July 1, 1901, balance unexpended	$1,829.35
Amount appropriated by river and harbor act approved June 13, 1902	48,000.00
	49,829.35
June 30, 1902, amount expended during fiscal year	793.34
July 1, 1902, balance unexpended	49,036.01

(See Appendix R R 8.)

8. Shoals in the St. Lawrence River between Ogdensburg and the foot of Lake Ontario.—In its original condition the channel of the St. Lawrence River, from Sister Island light down to the head of Brockville Narrows, was obstructed by 12 ledges, on which the depth was 9½ feet to 16 feet at low water.

The original project, act of September 19, 1890, was to remove to 18 feet below the zero of the Ogdensburg gauge ledges between Sister Island and Crossover lights, at an estimated cost of $43,305. In 1893, owing to the discovery of several outlying spurs, the estimated cost was increased to $54,772. By the act of June 3, 1896, the project was extended to embrace ledges in the St. Lawrence River between Ogdensburg and the foot of Lake Ontario.

April 13, 1897, the removal of the obstructions to a depth of 1.4 feet greater, i. e., to 18 feet below the zero of the Oswego gauge, was included in the project, thereby increasing the total estimated cost to $108,000.

The amount expended to June 30, 1902, was $67,581.94, all for works of improvement.

At this date all the rock ledges in United States waters had been removed to 18 feet below the zero of the Oswego gauge.

The maximum draft that could be carried over the locality under improvement at mean low water June 30, 1902, was 16 feet, and the usual variation of level of water surface is 3 feet.

All the commerce of the St. Lawrence River is benefited by this improvement. The project includes the removal of shoals in Canadian waters, but no appropriation was made in the last river and harbor act for this purpose, and no work can be done during the next fiscal year.

For more extended information see Annual Report of the Chief of Engineers for 1901, page 3373 et seq.

July 1, 1901, balance unexpended	$1,110.74
June 30, 1902, amount expended during fiscal year	692.68
July 1, 1902, balance unexpended	418.06

(See Appendix R R 9.)

9. Harbor at Ogdensburg, N. Y.—In its original condition the low-water depth in this harbor was 9 feet in the channel leading to the Oswegatchie River, 10 to 12 feet in the two lower entrance channels, and 6 to 12 feet along the city front.

The original project of 1868 was to dredge to the depth of 12 feet and to build, if necessary, 5,500 linear feet of piers, at an estimated cost of $100,000. The piers were never built. The project of 1882 provided for dredging the channel across the shoal to the mouth of the Oswegatchie to 16 feet and all other channels to 15 feet at extreme low water, at an estimated cost of $76,000. The present project (see Annual Report of the Chief of Engineers for 1890, p. 2872) provided for dredging all the channels to a depth of 16.5 feet below the zero of the Ogdensburg gauge (15 feet below the zero of the Oswego gauge), at an estimated cost of $158,950. The project was modified February 27, 1897, to deepen the two lower entrance channels to 16 feet below the zero of the Oswego gauge, and by act of March 3, 1899, further modified to dredge 900 feet of the channel along the front of Ogdensburg above Franklin street to but 14 feet below the same zero; elsewhere the projected depths to remain 15 feet.

The amount expended to June 30, 1902, was $297,313.27, of which $40,065.97 was applied to maintenance of improvement.

The maximum draft that could be carried over the improvement at mean low water June 30, 1902, was as follows: In the lower entrance channels, 15 feet; in the channel along the city front, 12 feet; elsewhere, 15 feet. The usual variation of level of water surface is 3 feet.

The following is a statement of commerce at this port for the past ten years:

	Tons.		Tons.
1892	625,846	1897	866,035
1893	908,048	1898	645,201
1894	736,084	1899	670,363
1895	693,825	1900	646,248
1896	886,438	1901 (incomplete)	439,148

Work proposed for the next fiscal year necessary to make improvement available consists in removing the hardpan at the mouth of the Oswego River and dredging channels wherever necessary.

For more extended information and map see Annual Report of the Chief of Engineers for 1881, page 2451 et seq.

July 1, 1901, balance unexpended	$636.53
Amount appropriated by river and harbor act approved June 13, 1902	20,000.00
	20,636.53
June 30, 1902, amount expended during fiscal year	594.24
July 1, 1902, balance unexpended	20,042.29

(See Appendix R R 10.)

10. St. Lawrence River at the head of Long Sault Island, New York.—This is a new work and consists of dredging a channel 1,700 feet long across a shoal at the head of Long Sault Island, in the St. Lawrence River, to be 150 feet wide and 18 feet deep.

No funds are yet available and no work has been done, the project having been adopted June 13, 1902.

The shoalest locality under improvement is 5 feet, and the usual variation of level of water surface is 2 feet. The commerce to be benefited is wholly prospective.

No additional work is proposed, it being intended to finish the work with this appropriation.

Amount appropriated by river and harbor act approved June 13, 1902	$48,000.00
July 1, 1902, balance unexpended	48,000.00

(See Appendix R R 11.)

PACIFIC COAST.

IMPROVEMENT OF RIVERS AND HARBORS IN CALIFORNIA SOUTH OF SAN FRANCISCO BAY.

This district was in the charge of Capt. J. J. Meyler, Corps of Engineers, to December 12, 1901; in the temporary charge of Lieut. Col. Charles E. L. B. Davis, Corps of Engineers, from December 13, 1901, to January 28, 1902; in the temporary charge of Lieut. Col. Thomas H. Handbury, Corps of Engineers, from January 28 to March 31, 1902, and in the charge of Capt. Edgar Jadwin, Corps of Engineers, since March 31, 1902. Division Engineer, Col. Jared A. Smith, Corps of Engineers, to September 23, 1901, and Lieut. Col. D. P. Heap, Corps of Engineers, from September 23 to December 13, 1901, and since March 31, 1902.

1. San Diego Harbor, California.—San Diego Harbor is just north of the national boundary of Mexico and 482 nautical miles south of San Francisco.

The river and harbor act approved March 3, 1875, appropriated $80,000 for the construction of a dike across the mouth of the San Diego River, causing it to empty into False Bay, and thus prevent San Diego Harbor from being injured by the deposit of material brought down during flood stages. This work was completed in 1876, at a cost of $79,798.72, which, with the cost of repairs made up to the time of adoption of the present project, brought this amount to $81,918.45.

The present project for the improvement of the harbor, approved December 8 and 30, 1890, has for its object the construction of a jetty on Zuninga Shoal, at the entrance to the harbor; the maintaining of a channel 24 feet deep at mean low tide and 500 feet wide through the middle ground, and the repairs of the dike. The jetty was to be about 7,500 feet long, extending from Coronado Island out on Zuninga Shoal, with a view to gaining 26 feet at mean low tide on the outer bar, where the survey of 1887 showed a depth of 21 feet.

The original estimated cost of this improvement was $394,400, but as work on the inner half of the jetty progressed under the different contracts it became evident that this sum would be inadequate. Therefore, under date of June 20, 1900, the local officer was authorized to change this estimated cost to $542,850.

The amount expended on the present project up to the close of the fiscal year ending June 30, 1902, is $273,863.75. The jetty has been completed for a distance of 4,595 feet, and the foundation course extended 430 feet farther.

No material results in the way of increased depth or width of channel over the outer bar have been obtained during the past fiscal year, the least channel depth being approximately 22 feet; the average height of all high waters above the plane of reference is 4.8 feet.

In 1896 a contract for further repairs on the restraining dike was made the cost of the work amounting to $4,913.58.

The river and harbor act of June 13, 1902, has appropriated $75,000 for continuing this improvement, with the proviso that a contract or contracts may be entered into by the Secretary of War for such materials and work as may be necessary to complete the approved project, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate $192,850 in addition to the $75,000 mentioned above. The work of continuing this improvement will be begun at an early date.

The commerce of this harbor was 121,130 tons for the year 1901, this being a decrease of 20 per cent over that of the previous year. The effect on commerce of this work of improvement will be to admit of the entrance of deeper-draft vessels, and to make their passage safer by straightening out the channel.

July 1, 1901, balance unexpended	$1,718.32
Amount appropriated by river and harbor act approved June 13, 1902	75,000.00
	76,718.32
June 30, 1902, amount expended during fiscal year	.52
July 1, 1902, balance unexpended	76,717.80
Amount (estimated) required for completion of existing project	192,850.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	192,850.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix S S 1.)

2. Deep-water harbor at San Pedro Bay, California.—The river and harbor act of June 3, 1896, provided for the appointment of a Board to determine upon the location of a deep-water harbor for commerce and for refuge in Santa Monica Bay, California, or at San Pedro, in the same State, the decision of a majority of the Board as to location to be final. The Board was to make plans, specifications, and estimates for said improvement. After the Board had rendered its decision and submitted its report the Secretary of War was empowered to make contracts for the completion of the selected harbor in accordance with the project of the Board, at a cost not exceeding in the aggregate $2,900,000.

In accordance with the provisions of this act a Board was appointed, which submitted its report March 1, 1897, deciding in favor of San Pedro Bay. The report of the Board is printed in Senate Doc. No. 18, Fifty-fifth Congress, first session.

On August 12, 1898, a contract was entered into with Messrs. Heldmaier & Neu, of Chicago, Ill., for the construction of the entire breakwater, the price bid by them being $1,303,198.54. The contractors were to commence work on or before November 12, 1898, and they were to so prosecute it as to earn each year the money appropriated by Congress.

This contract was annulled on March 19, 1900, the contractors having failed to attain the rate of progress required by the specifications.

On June 7, 1900, a contract for continuing and completing the construction of the breakwater was entered into with the California Construction Company, of San Francisco, Cal., and the same was approved by the Chief of Engineers on June 27, 1900; time of commencement of work to be August 4, 1900; rate of progress to be as required by the specifications. The estimated cost of this work at the prices bid for stone and concrete, and allowing 10 per cent for engineering expenses and contingencies, is $2,613,100.66.

Under this contract 645,149 tons of stone has been delivered and placed in the substructure of the breakwater. This substructure is practically completed for a distance of 4,016 feet from its westerly extremity, and has been more or less built up for a distance of 560 feet farther.

The amount expended on this work to June 30, 1902, is $537,982.63.

The commerce of San Pedro Harbor, heretofore simply an anchorage ground in open roadstead, is so intimately connected with that of Wilmington Harbor that reference is made thereto for statistics on same. The effect on commerce of this work will be to afford a place of refuge, easy of access and secure from storms, for coastwise and deep-draft vessels, and a protected harbor of about 1 square mile in area for the commerce of the latter class of vessels. Vessels while waiting for a favorable tide in order to enter the inner harbor of San Pedro now anchor in the lee of the partly built breakwater.

July 1, 1901, balance unexpended	[a] $575,152.92
Amount appropriated by sundry civil act approved June 28, 1902	311,085.00
	886,237.92
June 30, 1902, amount expended during fiscal year	352,691.31
July 1, 1902, balance unexpended	533,546.61
July 1, 1902, outstanding liabilities	32,679.51
July 1, 1902, balance available	500,867.10
July 1, 1902, amount covered by uncompleted contracts	2,093,975.95
Amount (estimated) required for completion of existing project	1,593,108.43
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	400,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix S S 2.)

3. Wilmington Harbor, California.—Wilmington is situated at the head of a small estuary which has its outlet in the bay of San Pedro, and is 393 nautical miles to the southward of San Francisco.

Previous to the commencement of the improvement, in 1871, there was a depth of less than 2 feet of water at low tide at the entrance.

The original project, approved July 1, 1871, contemplated gaining a depth of 10 feet at mean low tide. This depth was obtained in 1881, at a cost of $555,000, when a further project to increase depth of channel from 10 to 15 feet at mean low tide by dredging a reef and between the jetties, raising existing works, and extending the jetties to 18 feet of water in San Pedro Bay was submitted. This project was completed in 1893, at a cost of $399,497.68.

The river and harbor act of June 3, 1896, appropriated $50,000 for improving the harbor in accordance with a project submitted in 1894 for a channel depth of 18 feet at mean low tide, at an estimated cost of $392,725. Owing to certain provisos, however, this money was not available without further action by Congress.

The river and harbor act of June 13, 1902, provides for the further improvement of this harbor by appropriating $250,000 for carrying forward this work in accordance with the plan for its partial improvement as submitted in House Doc. No. 357, Fifty-sixth Congress, first session (see also Annual Report of the Chief of Engineers for 1900, pp. 4194–4211), including the construction or purchase of a suitable dredge; the unexpended $50,000 appropriated under act of June 3, 1896, is also made available for this work.

[a] A refundment of $299.58 was made in September, 1901, by the disbursing officer of the Board authorized by act of June 3, 1896, to locate the deep-water harbor, being the amount of a disallowance by the Auditor in settlement of his accounts. The amount expended by the Board is, therefore, $35,555.76, instead of $35,855.34, as heretofore reported.

This work, including dredge, is estimated to cost $550,000. Work on this project will be begun at an early date.

Up to the close of the fiscal year ending June 30, 1902, the amount expended on this improvement is $954,497.68, though no work has been done since 1893.

By this expenditure the available channel depth has been increased from 2 feet to approximately 15 feet at mean low tide, which is the least channel depth over the bar at the entrance at the close of the fiscal year; the average rise of the tide above this plane of reference is 5.1 feet.

The commerce of this harbor, which is principally coastwise, was 486,788 tons for the year 1901, an increase of 91.8 per cent over the previous year. No new steamship lines have been established during the year.

July 1, 1901, balance unexpended	$50,502.32
Amount appropriated by river and harbor act approved June 13, 1902	250,000.00
July 1, 1902, balance unexpended	300,502.32

(See Appendix S S 3.)

4. San Luis Obispo Harbor, California.—San Luis Obispo Harbor is 9 miles to the southward and westward of the town of San Luis Obispo, 216 nautical miles from San Francisco.

It is a bight of the coast about 18 miles long between Point San Luis on the north and Point Sal on the south. The upper end, where Port Harford is situated, has a wharf and is the part used for commercial purposes. Whaler Reef, extending nearly half a mile to the southward and eastward of Point San Luis, forms more or less of a natural breakwater, but during the winter season it is exposed to the heavy swell caused by southerly gales.

The original project, approved September 22, 1888, was to construct a breakwater of rough stone on Whaler Reef, extending from Point San Luis to Whaler Island, and thence to a point where the outer reef rises above high water. Its length when completed, including the island, was to be nearly 2,000 feet, and it was to be brought up to the plane of mean low water, at an estimated cost of $284,898. This project was subsequently modified, January 17, 1893, so as to raise the structure to a height of 6 feet above high water, with a thickness on top of 20 feet and such side slopes as may be assumed under the action of the sea. The estimated cost was increased to $568,660.

The amount expended up to the close of the fiscal year ending June 30, 1902, was $228,799.06.

The completed breakwater has been built from Point San Luis and extended to a distance of 745 feet from Whaler Island, and a section, more or less completed, has been built 455 feet farther. The result has been to give increased security to vessels at the landing and anchorage against heavy swells.

The storms of the last two winters have knocked down a portion of the outer end of the breakwater. More or less stone has also been knocked off in other places by the heavy seas breaking over the structure.

The river and harbor act approved June 13, 1902, appropriated $50,000 for continuing this improvement, and work will be begun at an early date.

The commerce of this harbor was 40,996 tons for 1901, an increase of 16 per cent over that of the previous year.

July 1, 1901, balance unexpended	$1,200.94
Amount appropriated by river and harbor act approved June 13, 1902	50,000.00
July 1, 1902, balance unexpended	51,200.94
July 1, 1902, outstanding liabilities	41.25
July 1, 1902, balance available	51,159.69

(See Appendix S S 4.)

5. Removing sunken vessels or craft obstructing or endangering navigation.—The wreck of a sailboat (name unknown) was removed from the channel in the inner harbor at San Pedro on October 28, 1901, at a cost of $75.

(See Appendix S S 5.)

IMPROVEMENT OF RIVERS AND HARBORS IN CALIFORNIA TRIBUTARY TO AND NORTH OF SAN FRANCISCO BAY, AND OF PEARL HARBOR, HAWAII.

This district was in the charge of Lieut. Col. W. H. Heuer, Corps of Engineers.

1. Harbor at Alviso, Cal.—Alviso Slough, before improvement, was a small tidal estuary about 3½ miles in length, from 60 to 800 feet in width, and from 3 to 7 feet in depth at low water. The range of the tide varies from 7 to 11 feet. The village of Alviso is situated at the head of the slough.

Congress required preliminary examination of this slough in 1890 and again in 1892, and a survey with estimate for improvement in 1896. All reports of examinations made stated that the slough was unworthy of improvement by the General Government. The report of 1896 submitted a plan for a dredged channel 7 feet deep at low water, 60 feet wide generally, and 80 feet wide opposite the wharves, and for a V-shaped turning basin in front of the village, so that boats could turn around. The estimated cost of the project was $48,000. By act of March 3, 1899, Congress appropriated $48,000 to carry out the above-outlined project.

A project for the work, based upon the project adopted by Congress, was approved May 11, 1899. Under it a contract was let in September, 1899, for doing the work required. The contractor failed to do any work, and the contract expired by limitation. The collection of the amount of the bond $10,000, given by the United States Fidelity and Guaranty Company of Maryland for the faithful fulfillment of the contract, has been turned over to the Department of Justice.

Contract for the work was again let in May, 1900, and the work was completed in June, 1901, leaving a channel of the full width and depth contemplated by the approved project.

The amount expended on the existing project to June 30, 1902, which resulted in the completion of the project as adopted, was $27,543.47, leaving an available balance of $20,456.53, which may possibly be increased by the $10,000 due from the surety company referred to.

By act of June 13, 1902, Congress made the unexpended balance, remaining from the appropriation heretofore made, available for the extension and further improvement of the channel heretofore made.

The improvement made has practically been maintained, but as far as can be ascertained has resulted in no increase of commerce. In 1901 a small steamer, the *San Jose*, 192 tons gross tonnage, made daily

trips from San Francisco to Alviso, carrying passengers and freight. The business done was very small, but a statement of the amount could not be obtained. A few scow-schooners also made occasional trips into Alviso Slough.

July 1, 1901, balance unexpended	$21,621.91
June 30, 1902, amount expended during fiscal year	1,165.38
July 1, 1902, balance unexpended	20,456.53

(See Appendix T T 1.)

2. Redwood Creek, California.—This creek is tributary to San Francisco Bay, and the sum of $23,400 was expended on its improvement prior to June 30, 1895.

The river and harbor act of June 13, 1902, provides for the further improvement of this stream, in accordance with plan printed in House Doc. No. 87, Fifty-fourth Congress, second session, and in the Annual Report of the Chief of Engineers for 1897, page 3349. This plan contemplates dike construction and dredging at an estimated cost of $8,400, with a view of obtaining a 5-foot channel up to the Redwood City wharf.

No work was in progress during the year.

Amount appropriated by river and harbor act approved June 13, 1902	$8,400.00
July 1, 1902, balance unexpended	8,400.00

3. Harbor at San Francisco, Cal.—The river and harbor act of March 3, 1899, provided for the removal to a depth of 30 feet below low water of Shag Rock No. 1, Shag Rock No. 2, and Arch Rock, situated in San Francisco Bay, which were considered a menace to navigation.

Project, which provided for making a continuous contract for the removal of all three rocks, was approved April 10, 1899, and under it contract for the work was made. Shag Rock No. 1 was removed by July 30, 1900, and Shag Rock No. 2 by April 5, 1901. Work was then commenced on Arch Rock, and is still in progress.

Up to June 30, 1902, $161,761.30 has been spent on this work, with the result that Shag Rock No. 1 and Shag Rock No. 2 have both been removed to a depth of 30 feet below low water, and 44 per cent of the area of Arch Rock has also been removed down to the same grade plane.

The river and harbor act of June 13, 1902, provided as follows:

> Improving San Francisco Harbor, California, by the removal of Blossom Rock: The river and harbor Act of March third, eighteen hundred and ninety-nine, wherein provision was made for removing Arch Rock and Shag Rocks to a depth of thirty feet below mean low water, is hereby amended so as to include Blossom Rock, and all the provisions of said act are hereby made applicable to Blossom Rock as fully as to Arch Rock and Shag Rocks.

July 1, 1901, balance unexpended	$214,488.86
June 30, 1902, amount expended during fiscal year	106,250.16
July 1, 1902, balance unexpended	108,238.70
July 1, 1902, amount covered by uncompleted contracts	103,916.38
Amount (estimated) required for completion of existing project	92,600.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	50,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix T T 2.)

4. Oakland Harbor, California.—In its original condition the depth of the entrance to San Leandro estuary, which is now Oakland Harbor, was 2 feet at low tide, and admitted vessels of from 5 to 8 feet draft at high tide.

The project for the improvement, which was approved February 15, 1874, had for its principal features (1) a mid-tide training wall of rubblestone extended from the shore westward into San Francisco Bay about 2 miles; (2) a connection by a canal, 2½ miles in length, with San Leandro Bay; (3) a dam at the entrance to San Leandro Bay; (4) draining basin and channel, the latter to have a depth of 20 feet at low water.

Two modifications were later adopted, viz: One in 1875 to increase the width of the tidal canal to 400 feet, and the other in 1878 to raise the training walls to full-tide height.

Up to the present time $2,550,600 has been appropriated for this work.

Up to June 30, 1902, $2,324,680.35 has been expended. The result is practically the construction of Oakland Harbor, and includes a channel 300 feet wide and 20 feet deep at low water from the bay of San Francisco to Webster Street Bridge; two stone jetties, one 12,000 feet long and the other 10,000 feet long, built into San Francisco Bay on the north and south sides of the jetty channel; a tidal basin about 2 feet deep at low water, covering about 300 acres; a tidal-basin channel in front of Brooklyn, 6 feet deep at low water, 200 feet wide, and 5,000 feet long; portion of the tidal canal, about 80 per cent of which is completed; and bridges connecting East Oakland and Alameda, built over the tidal canal at Park street, Fruitvale avenue, and High street.

A release has also been obtained, by the payment of $50,000 to the Central Pacific Railway Company, from the obligation to build a bridge across the tidal canal at Washington avenue, which was imposed by the decree of the court condemning the site for the tidal canal.

The act of June 13, 1902, contains the following:

> Improving Oakland Harbor, California, in accordance with the report submitted in House Document Numbered Two hundred and sixty-two, Fifty-sixth Congress, second session, one hundred thousand dollars: *Provided*, That a contract or contracts may be entered into by the Secretary of War for such materials and work as may be necessary to prosecute said project, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate one hundred and fifty thousand dollars, exclusive of the amounts herein and heretofore appropriated.

July 1, 1901, balance unexpended	$335,538.04
Amount appropriated by river and harbor act approved June 13, 1902	100,000.00
	435,538.04
June 30, 1902, amount expended during fiscal year	209,618.39
July 1, 1902, balance unexpended	225,919.65
July 1, 1902, amount covered by uncompleted contracts	54,572.20
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	150,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix T T 3.)

5. San Pablo Bay, California.—This is a new work. The river and harbor act of June 13, 1902, provides for constructing a channel

between the Strait of Karquines and the Golden Gate, off Point Pinole, Point Wilson, and Lone Tree Point, 300 feet wide and 30 feet deep, in accordance with report printed in House Doc. No. 89, Fifty-sixth Congress, first session, and in the Annual Report of the Chief of Engineers for 1900, page 4260. A continuing contract in the sum of $281,000, exclusive of the amount appropriated, is authorized for completing the project. The estimated cost of this work is $381,000, and $16,000 annually for maintenance.

There were no operations during the past year.

Amount appropriated by river and harbor act approved June 13, 1902	$100,000.00
July 1, 1902, balance unexpended	100,000.00
Amount (estimated) required for completion of existing project	281,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	200,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

6. San Joaquin River, California.—Before improvement the low-water channel to Stockton was only 6 feet in depth, and contained several sharp bends, where navigation was difficult, while the upper river, above Stockton, was navigable for but a few months in the year during high-water stage.

The project for improvement, which was made and approved in 1877 and slightly modified in 1881 and 1888, had for its object to secure and maintain by dredging a channel 9 feet deep at low water and 100 feet wide, through the tidal portions of the river and Stockton channel to Stockton, and a channel in Mormon Slough, 4 feet deep at low water and 80 feet wide, to Miller's warehouse; also the temporary improvement of the low-water channel of the upper river by dredging, scraping, removal of snags, and the closure or partial closure of Paradise Cut and Laird Slough.

The amount expended on this improvement to June 30, 1902, has been $434,794.01. The results obtained have been the maintenance of a channel to Stockton, practically 9 feet in depth, the result of dredging carried on each year since 1877; the straightening of the river 4½ miles by cut-offs which have been made, three near Devils Elbow, one at Head Reach, a double cut-off in the narrows below Stockton, and a double cut-off at Twenty-one Mile Slough, and the improvement of the navigation of the upper river by the removal of snags and the partial closure of Paradise Cut and Laird Slough by dams.

During the past fiscal year $13,821.05 has been expended on this work, in dredging in Stockton channel and in the river below Stockton.

It is proposed to apply the balance available, $34,705.99, to maintaining 9 feet depth to Stockton, and such other work under the approved project as may be necessary to prevent interruption to commerce.

Most of the dredging done in Stockton channel has been rendered necessary by the enormous amount of detritus brought down by the winter and spring floods through Mormon Slough from the Calaveras River; but by act of June 13, 1902, Congress appropriated funds for the diversion of the waters of Mormon Slough.

The commerce of the lower San Joaquin River, below Stockton, is large and important. It is carried on 13 steamers, averaging 550 tons each; 14 barges, averaging at least 100 tons each, and many scow-schooners. On the upper river it is small, uncertain, and unimportant, for many years there being no navigation owing to failure of crops

from drought and extremely low stages of water. During 1901 the commerce of the San Joaquin River was reported as 357,746 tons and 84,842 passengers, of which only 10,000 tons of freight was carried on the upper river.

On June 30, 1902, the maximum draft that could be carried to Stockton was 10 feet at mean low tide, the river not having yet fallen to its lowest stage.

July 1, 1901, balance unexpended	$30,527.04
Amount appropriated by river and harbor act approved June 13, 1902	18,000.00
	48,527.04
June 30, 1902, amount expended during fiscal year	13,821.05
July 1, 1902, balance unexpended	34,705.99

(See Appendix T T 4.)

7. Stockton and Mormon channels, San Joaquin River, California.—The river and harbor act of June 13, 1902, provides for improvement of this locality in accordance with report printed in House Doc. No. 152, Fifty-fifth Congress, third session, and in the Annual Report of the Chief of Engineers for 1899, page 3189. The plan of improvement proposes the diversion of the waters of Mormon channel, to be accomplished by means of a dam to be located about 3 miles east of Stockton, and the construction of a canal 24,850 feet long, 150 feet wide at the bottom, thence to the north branch of Calaveras River, the estimated cost being $255,016, which includes the cost of dredging in the river, purchase of right of way, changing of grades of highways and bridges, and dredging in Mormon and Stockton channels.

The act authorized the letting of a continuing contract in the sum of $175,000, exclusive of the amount appropriated, for completing the project.

No work has yet been done.

Amount appropriated by river and harbor act approved June 13, 1902	$50,000.00
July 1, 1902, balance unexpended	50,000.00
Amount (estimated) required for completion of existing project	205,016.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance expended July 1, 1902	50,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

8. Mokelumne River, California.—This river, a tributary of the San Joaquin, is a tidal stream, and is navigable to New Hope Landing, 13 miles above its mouth.

Before improvement navigation was difficult on account of overhanging trees, numerous snags, and a shoal opposite New Hope Landing.

Project was made and approved in 1884 to remove snags and overhanging trees. This project was modified August 31, 1894 (approved September 11, 1894), to include the removal of a point of land opposite New Hope Landing. Appropriations aggregating $18,000 were made in 1884, 1886, 1888, 1892, and 1894, and as funds have been available work has been done on the river in accordance with the approved project, which has been completed The amount expended to June 30, 1902, was $17,111.66.

No attempt at improving the depth of the stream has been made.

It has been widened by the removal of overhanging trees, and there is now no obstacle to navigation for such craft as use this river.

The amount of commerce varies with the amount of crops grown, and for 1901 was reported as 81,701 tons. Practically all that grows on or near the banks of the river is transported by the water route.

Two stern-wheel steamers, the *Aurora*, 402 tons, and the *Constance*, 402 tons, running on alternate days, maintain a daily service for passengers and freight between San Francisco and New Hope Landing.

No work has been done since 1896 and no deterioration of channel has been reported. The maximum draft that can be carried to New Hope Landing at mean low water is fully 3 feet.

July 1, 1901, balance unexpended	$888.34
July 1, 1902, balance unexpended	888.34

(See Appendix T T 5.)

9. Sacramento and Feather rivers, California.—An act of Congress of June 3, 1896, provided for the appointment of a Board of three Engineer officers for the purpose of carrying on the improvement of the Sacramento and Feather rivers.

The condition of the Sacramento River below Sacramento before improvement was such that boats drawing about 7 feet depth of water could at low-water stage reach Sacramento. Above Sacramento navigation was difficult and dangerous, on account of numerous snags, shoals, and rapids.

The original project of 1874 contemplated the improvement of the low-water channels of the Upper Sacramento and Feather rivers by removing snags, scraping bars, and the construction of temporary wing dams. In 1890 the project was enlarged to include the closure of a large crevasse at Paine's break, 1¾ miles below Sacramento. In 1892 the project was again enlarged to include the closure of Jacob Slough, a crevasse about 14 miles above Sacramento, and the treatment of the Yuba River near and above Marysville, where enormous quantities of mining detritus had been deposited, and in 1893 to build wing dams at Heacock Shoals, below Sacramento.

The Board of Engineer officers herein referred to made its preliminary report and estimate on December 14, 1897, and recommended channel contraction to obtain low-water channel depths of 7 or 8 feet at localities below Sacramento where the river was abnormally wide.

On October 11, 1898, the Board made a more elaborate report, which is printed in the Annual Report of the Chief of Engineers for 1899, page 3173, from which it appears that the Sacramento River below Sacramento can be improved by a system of wing dams, supplemented by dredging, if necessary, at certain shoals, to give a least depth of 7 feet, at an estimated cost of $280,000; that a 4-foot depth can be maintained above Sacramento to Colusa, and a 3-foot depth thence to Redbluff, by the removal of snags and the concentration of channel widths by temporary works, as has been the practice heretofore, at an annual estimated expense of $25,000.

The Board also expressed the opinion that no permanent improvement, at reasonable or justifiable cost, can be carried out on the Feather River until the flow of sand and other mining detritus from the Yuba and Bear rivers is stopped.

On March 3, 1899, Congress, in accordance with recommendations in said report, appropriated $30,000 for continuing improvement of

the Sacramento River from the city of Sacramento to the mouth of the river, and authorized continuing contracts to the limit of $280,000.

The total expenditure for improvement on the Sacramento and Feather rivers to June 30, 1902, amounted to $792,154.67. The sundry civil act of June 6, 1900, contained an item of $60,000 for continuing improvement from Sacramento to the mouth of the river.

With the $90,000 appropriated contracts were made (under projects approved May 19, 1899, and July 2, 1900) in September, 1899, and in March, 1901, to build wing dams at certain localities between the city of Sacramento and the mouth of the Sacramento River. Forty-four wing dams, consisting of piles, brush, and rock, were constructed, of an aggregate length of 8,850 feet, or an average length of about 201 feet, at a total cost (including engineering, office, and all other expenses) of $32,211.71, or an average cost of $3.64 per linear foot of completed wing dam.

In the fiscal year ending June 30, 1902, 33 of these wing dams were completed, aggregating 6,952 feet in length, at a total cost (including all engineering expenses) of $24,069.96. The result is a least channel depth of 7 feet, and probably 100 feet in width, at low-water stage on all shoals between Sacramento and the mouth of the river, at a cost of about 11.5 per cent of the estimated cost of the improvement. Unless other shoals should develop at unexpected localities, it is believed that no work of any consequence, other than snag removal, maintenance, and slight repairs to existing wing dams will be required on the lower river in the near future.

The work of snag removal in the lower river was inadvertently omitted from the Board's reports of 1897 and 1898, which are printed in House Doc. No. 186, Fifty-fifth Congress, second session, and House Doc. No. 48, Fifty-fifth Congress, third session, referred to in the appropriation act of March 3, 1899. By strict construction of the latter act, none of the money appropriated would be available for snagging in the river below Sacramento. Snags accumulate in this portion of the river and must be removed to maintain navigation. The Board recommends that any unexpended balance from the appropriation for improving Sacramento River below Sacramento be made available for use of snagging when necessary.

A slight tidal influence is now felt at Sacramento. The vertical range of the river at Sacramento is about 21 feet; at the mouth of the river the extreme tidal range is about 7 feet. The advantage derived from the improvement has been such that during the past year no vessel has been reported aground or delayed in consequence of shoal water. No reduction of transportation or insurance rates nor increase in volume of business has been reported as a result of the improvement.

A full description of the rivers, with commercial statistics, is found in the Annual Report of the Chief of Engineers for 1889, page 3173.

SACRAMENTO AND FEATHER RIVERS.

July 1, 1901, balance unexpended		$633.53
Amount appropriated by river and harbor act approved June 13, 1902		25,000.00
		25,633.53
June 30, 1902, amount expended during fiscal year		576.49
July 1, 1902, balance unexpended		25,057.04

SACRAMENTO RIVER.

July 1, 1901, balance unexpended	$81,858.25
June 30, 1902, amount expended during fiscal year	24,069.96
July 1, 1902, balance unexpended	57,788.29

(See Appendix T T 6.)

10. Petaluma Creek and Napa River, California.—(*a*) *Petaluma Creek.*—This creek is an estuary of San Pablo Bay, and is navigable for 16 miles of its length, to the head of navigation at Petaluma, a town of about 4,000 inhabitants.

Before improvement it was very crooked, dry in places at low water, and navigation was dependent entirely on the tide.

In 1880 project was made and approved for straightening the stream by making cut-offs and dredging to obtain a channel 50 feet wide and 3 feet deep at low tide. Project was extended July 28, 1892 (approved August 5, 1892), to dredge the channel as deep as funds would permit.

Up to June 30, 1902, $64,730.07 has been expended on this improvement, with the result that the channel has been shortened 2.5 miles and dredged to a least width of 50 feet and a least depth of 4 feet near the town of Petaluma, and of 6 feet in the lower portion at mean low stages of tide. The depth of the channel near the town of Petaluma has since deteriorated to 3 feet.

The sum of $43.10 was expended during the past fiscal year for removing some old piles near the channel which were a menace to navigation. Traffic was uninterrupted. The least depth of water that can be carried to Petaluma, the head of navigation, is 3 feet at mean low tide.

The commerce of Petaluma Creek is carried on one steamboat (294 tons), and numerous scow-schooners, which carry the heavier freight. No statement of the amount of freight carried in 1901 could be obtained.

The drainage area of this stream is about 83 square miles of land, mostly agricultural; consequently large quantities of detritus are annually carried into the channel, which the tide waters are unable to carry out; hence redredging will be required every two or three years to maintain navigation.

(*b*) *Napa River.*—Napa River before improvement had an average low-water depth of 5 feet, with the exception of the bars, where the depth was reduced to less than 1 foot on the crests. The ordinary rise of the tides being 5 feet, there was each day a practicable depth of 6 feet.

The approved project, adopted in 1888, consists in dredging the bars between Carr Bend and Vernon Mills, in the immediate vicinity of Napa City, cutting off projecting points of land so as to obtain a channel 75 feet wide and 4 feet deep at mean low water, and removing obstructions, such as snags, logs, etc.

Work under this improvement was begun in 1889, and has been carried on ever since when work was necessary and funds were available.

Up to June 30, 1902, $25,086.59 has been expended on this improvement, with the result that a channel has been dredged through the different bars between Carr Bend and the highway bridge at Third street, Napa, the head of navigation, and the river has been kept clear of snags and logs obstructing navigation.

No work was done during the past fiscal year. During the fiscal year the sum of $10.08 was expended on an inspection of the stream.

The commerce of the stream is carried on two steamers, which, running on alternate days, maintain a daily service, and several scow-schooners. The amount of tonnage reported for the year 1901 was 108,526 tons.

July 1, 1901, balance unexpended	$736.52
Amount appropriated by river and harbor act approved June 13, 1902	6,000.00
	6,736.52
June 30, 1902, amount expended during fiscal year	53.18
July 1, 1902, balance unexpended	6,683.34

(See Appendixes T T 7 and 8.)

11. Humboldt Harbor and Bay, California.—Before improvement the harbor was obstructed by a troublesome and variable sand bar inclosing the entrance about a mile distant. Across the submerged bar was a channel which was exceedingly shifting, uncertain, and dangerous. Its low-water depth has been occasionally as much as 25 feet and frequently as little as 9 feet. The bar constantly changed in position, the greatest range being about 1½ miles. Vessels were often storm bound in the harbor for long periods. There were also numerous shoals within the harbor close to the wharves, rendering it difficult for vessels to reach Eureka, Arcata, and Hookton, the main shipping points on the bay.

In 1882 a project was adopted for improving the entrance, with the object of increasing the depth of water over the bar by constructing a low-tide brush and stone jetty, extending seaward from the end of the south spit for a distance of 6,000 feet. Its estimated cost was $600,000. In 1891 a Board of Engineer officers recommended the raising of this jetty to high tide and the addition of another, making two stone and brush jetties, nearly parallel, about 2,100 feet apart, starting from the north and south spits, respectively, and extending seaward to the 18-foot contour, with such groins as might be found necessary during the progress of the work. The north jetty was not to be begun until the completion of the south jetty. The total cost of these jetties and the necessary bank protection was estimated at $1,715,115 in addition to the sum which had already been appropriated. In 1892 the project was slightly modified so as to start the north jetty from the end of the dike already built for shore protection, making that a part of the jetty. The construction of the north jetty, so far as thought necessary to prevent erosion, without waiting for the completion of the south jetty, was also authorized. The river and harbor act of July 13, 1892, placed the improvement under the continuous-contract system.

The first project for dredging inside the harbor was made and approved in 1881, and provided for securing by dredging a channel 12 feet deep and 200 feet wide to the head of Eureka wharves, and one of 10 feet deep and 100 feet wide to Arcata and Hookton. This project was completed in 1884. Project for further dredging inside the harbor was approved March 27, 1899. This project provided for dredging a channel 15 feet deep at low water and as wide as the funds would permit from the deeper water in Humboldt Bay to and in front of the wharves at the town of Eureka. This project was completed

in March, 1900, and gave a channel up to and in front of the town of Eureka 8,900 feet long, 200 feet wide, and 15 feet deep at low water.

The amount expended on this work to June 30, 1902, is $2,174,275.26, of which $130,884.69 has been expended on dredging in the inner harbor and $2,043,390.57 on improving the entrance.

The result was the completion of all the projects for improving the entrance and dredging the inner harbor. A channel between the jetties, 1,350 feet wide and 28 feet deep at low water, was procured immediately upon the completion of the jetties, but as they became beaten down by the action of the sea, it is probable that this depth has been somewhat, but not materially, reduced. The channel width has been maintained.

During the past fiscal year $1,063.66 was spent for the services of a custodian to care for the plant on the site, and for such minor repairs as were necessary. A balance of $13,339.74 is available, which could be applied to the maintenance of the jetty works, if necessary.

During the year 1901, 1,688 vessels, having a gross tonnage of 567,692 tons, passed over Humboldt bar; but large and important as this commerce is, the improvements made are believed to have provided a harbor in every way adequate to the demands of the commerce of the port.

July 1, 1901, balance unexpended	$14,403.40
June 30, 1902, amount expended during fiscal year	1,063.66
July 1, 1902, balance unexpended	13,339.74

(See Appendix T T 9.)

12. Pearl Harbor, Hawaii.—Pearl Harbor is situated on the island of Oahu, about 8 miles west of the city of Honolulu. It is a safe and commodious harbor, with deep water, but the entrance is obstructed by a bar about 1,900 feet through, having at low water only about 10 feet of water over it at its shoalest place.

A full description of the harbor is printed as Senate Ex. Doc. No. 42, Fifty-third Congress, third session.

The river and harbor act of March 3, 1899, provided as follows:

> Improving Pearl Harbor, Hawaii, in accordance with the report submitted by Rear-Admiral Walker, July eleventh, eighteen hundred and ninety-four, and contained in Senate Executive Document Numbered Forty-two, Fifty-third Congress, third session: Completing improvement, one hundred thousand dollars.

The project for the expenditure of the funds appropriated, which was approved December 5, 1900, provided for dredging, by contract, a channel through the bar, 30 feet deep at low water, and as wide as the funds would permit. Contract was entered into and approved July 25, 1901, at 44½ cents per cubic yard. Work was not commenced until March, 1902, and at the end of the fiscal year only about 20,000 cubic yards had been removed from the bar, the slow progress being due to the inadequacy of the plant provided by the contractor for the work.

July 1, 1901, balance unexpended	$99,769.51
June 30, 1902, amount expended during fiscal year	1,751.77
July 1, 1902, balance unexpended	98,017.74
July 1, 1902, amount covered by uncompleted contracts	89,000.00

(See Appendix T T 10.)

IMPROVEMENT OF RIVERS AND HARBORS IN WESTERN OREGON, OF COLUMBIA RIVER ABOVE THE MOUTH OF WILLAMETTE RIVER, INCLUDING SNAKE RIVER, OREGON AND WASHINGTON, AND OF CLEARWATER RIVER, IDAHO.

This district was in the charge of Capt. W. C. Langfitt, Corps of Engineers. Division Engineer, Col. Jared A. Smith, Corps of Engineers, to September 23, 1901; Lieut. Col. D. P. Heap, Corps of Engineers, from September 23 to September 30, 1901, and Lieut. Col. W. H. Heuer, Corps of Engineers, since September 30, 1901.

1. Coquille River, Oregon (general improvement).—This stream empties into the Pacific Ocean at Bandon, Coos County, Oreg., about 375 miles north of San Francisco. Once safely across the bar at the mouth of the river vessels drawing about 11 feet of water experience no special difficulty in ascending the stream at high tide to the town of Coquille, about 25 miles above Bandon.

Before improvement the channel at the mouth of the river skirted the south headland for some distance, as shown on map opposite page 2682 of the Annual Report of the Chief of Engineers for 1882, and was shoal, shifting, and studded with dangerous rocks. The depth of the water on the ocean bar at the original mouth of the river was usually about 3 feet at low tide, or a little over 7 feet at high tide.

The original plan for improvement was approved in 1878 (report printed in the Annual Report of the Chief of Engineers for 1879, p. 1806), and provided for the construction of two converging high-tide jetties, built of rubblestone, 800 feet apart, so located as to cause the river to empty into the sea about one-half mile north of the original mouth of the river, these jetties to run out to sea a sufficient distance to create and maintain a channel 12 feet deep at low tide. In 1880 the proposed depth of 12 feet at low tide, to be obtained in the channel at the new mouth of the river, was reduced to 10 feet; in 1888 it was reduced to 8 feet, and under date of May 8, 1891, the plan was changed to provide that the jetties should be 600 feet apart at their outer ends, instead of 800 feet.

The amount expended on original and modified projects prior to operations under existing modified project was $102,299.98, including $6,883.90 for snagging.

The existing modified project may be said to date from 1892, when the lengths of the proposed jetties were definitely fixed, and the character of the construction changed by adopting jetties more in conformity to those at Coos Bay and Yaquina Bay.

The estimated cost for completing the improvement, including previous appropriations (and including $6,883.90 expended in removing snags in the river between Coquille and Myrtle Point, under acts of Congress of August 11, 1888, and September 19, 1890), was increased from $164,200 to $285,000 (Annual Report of the Chief of Engineers for 1892, pp. 2664–2665).

The modified project was approved by the Chief of Engineers February 20, 1892.

The expenditures on the original and modified projects to June 30, 1902, amount to $208,051.82, of which the sum of $20,874.41 was for maintenance.

The expenditures for the fiscal year ending June 30, 1902, amounting to $1,432.68, were in connection with caring for and maintaining the Government plant used in constructing the jetties in past years.

On account of the limited amount available no work was practicable during the past fiscal year.

The total expenditures to date on the original and modified projects have resulted in completing the south jetty throughout its projected length of about 2,700 feet, in constructing about 500 feet of the proposed 1,500-foot north jetty, and in removing some of the principal snags obstructing navigation between Coquille City and Myrtle Point.

The jetty work has closed up the dangerous old channel at the mouth of the river and opened up a new channel straight out to sea, with a depth on the bar ranging from 4 to 10 feet at mean low tide.

The maximum draft that could be carried June 30, 1902, at mean low tide in the new channel at the mouth was about 6 feet. The average daily range of tide on the Coquille bar is 4.2 feet.

The principal articles of commerce carried over the bar in the ocean at the mouth of the river are lumber and coal. This commerce is loaded on small coasting vessels along the 25 miles of the river between its mouth and Coquille, and by them taken to San Francisco for market. The river and ocean form the only practicable means for transporting the commerce of the region to market.

COMMERCIAL STATISTICS.

	Tons.		Tons.
1879	7,000	1892	19,362
1882	6,630	1893	14,491
1883	9,438	1894	14,180
1884	13,100	1895	16,256
1885	7,649	1896	21,106
1886	9,080	1897	25,620
1887	6,631	1898	24,556
1888	29,197	1899	26,654
1889	29,309	1900	30,727
1891	15,994	1901	32,975

NOTE.—The statistics for 1895–1901, inclusive, are for calendar years; those for years prior to 1895 are for fiscal years ending June 30. Statistics for years not named are not available.

July 1, 1901, balance unexpended	$3,380.86
Amount appropriated by river and harbor act approved June 13, 1902	30,000.00
	33,380.86
June 30, 1902, amount expended during fiscal year	1,432.68
July 1, 1892, balance unexpended	31,948.18
July 1, 1902, outstanding liabilities	104.00
July 1, 1902, balance available	31,844.18

(See Appendix U U 1.)

2. Coquille River, Oregon, between Coquille and Myrtle Point.—When there is sufficient water small steamboats and launches navigate the 13 miles of the Coquille River between Coquille and Myrtle Point.

During a portion of each year, however, navigation is impracticable above a point 8½ miles above Coquille on account of the small volume of the river and a number of shoals.

The original project was adopted in 1892 (report printed in the Annual Report of the Chief of Engineers for 1891, pp. 3280–3283). It provided for the construction of pile dikes to narrow the channel to 50 feet in width in order to secure a probable depth of 4 feet at mean low tide, at an estimated cost of $26,000.

There was expended on the original project $7,804.29, mostly for snagging operations.

The original project was modified consequent to survey of 1894 (report of survey printed in Annual Report of the Chief of Engineers for 1899, pp. 3350–3351). It was approved by the Chief of Engineers March 14, 1895, and provides for deepening the channel between Coquille and Myrtle Point to 4 feet at mean low tide for a width of 50 feet by removing snags, dredging shoals, and constructing contraction dikes at shoals.

The estimated cost of the modified existing project is $43,176.40, exclusive of what had been spent under the original project.

The amount expended on the original and modified projects to June 30, 1902, is $31,000.

The amount expended to date on the modified project was for removing snags, dredging shoals, and constructing two contracting dikes, confining the channel for a distance of about five-eighths of a mile between two rows of pile dikes 60 feet apart.

This work resulted in providing, temporarily, a channel of the projected depth and width at mean low water from Coquille up to Rackliffs Landing, 11½ miles; during the past year, however, considerable shoaling has taken place.

The expenditures during the fiscal year ending June 30, 1902, were for removing a small obstruction to navigation and for caring for the Government plant used in operations in past years, and consequently were for maintenance of improvement.

The maximum draft that could be carried June 30, 1902, at mean low tide in the 11½ miles from Coquille up to Rackliffs Landing was about 2 feet, while at places in the 1½ miles from Rackliffs Landing to Myrtle Point the depth of the stream at low water was only a few inches.

The average rise and fall of the tide in the Coquille River at the mouth of the North Fork, a short distance below Myrtle Point, is 3½ to 4 feet.

The officer in local charge of the improvement reports that the conditions have changed since the adoption of the present project for improvement, and that a revision of the project therefore appears to be advisable.

The commerce carried by the several small boats plying above Coquille consists principally of farm products and is inconsiderable in volume. A railroad parallels the stream between Coquille and Myrtle Point.

COMMERCIAL STATISTICS.

	Tons.		Tons.
1893	1,242	1898	4,915
1894	1,692	1899	3,399
1895	1,409	1900	3,783
1896	3,205	1901	3,888
1897	4,293		

NOTE.—The statistics for 1893–1895 are for fiscal years ending June 30; for 1896–1901 they are for calendar years.

July 1, 1901, balance unexpended	$34.82
June 30, 1902, amount expended during fiscal year	34.82

(See Appendix U U 2.)

3. Entrance to Coos Bay and Harbor, Oregon.—Coos Bay is a tidal estuary on the Pacific coast in Oregon, about 400 miles north of San Francisco. It is the principal harbor between the mouth of the Columbia River and San Francisco. Before improvement the obstructions consisted of the usual bar in the ocean at the entrance to the bay and shoals inside the bay near its entrance, formed by sands which accumulated during northwesterly winds. Under the influence of these winds the sand spit on the north side of the entrance advanced toward the south, contracting the channel under the high stone headland, known as Coos Head, on the south side of the entrance, to a very narrow width, and usually causing the channel across the bar in the ocean at the entrance to follow the west side of the north spit in a tortuous course. The depth on the ocean bar was often but 10 feet at low tide.

The original project for the improvement of Coos Bay received the approval of the Secretary of War November 24, 1879.

It provided for the construction of a jetty from a point about 250 yards below the southern extremity of Fossil Point on a line toward the east end of Coos Bay, this line curving so as to be directed at its outer end to the head, or a little north of it; the structure to be of wood and stone, or stone, as may be found best.

The estimated cost was $600,000.

The amount expended on the original project was $213,750. Under the original project 1,760 feet of timber crib and rubblestone jetty was built.

The existing project (printed in the Annual Report of the Chief of Engineers for 1890, pp. 2936–2965) provides for obtaining and maintaining a channel 20 feet deep at low tide through the ocean bar at the entrance to the bay, by confining the entrance between two high-tide rubblestone jetties, the north jetty to be 9,600 feet long and the south jetty 4,200 feet long.

The estimated total cost of the existing project, exclusive of the amount expended on the original project, is $2,466,412.20.

The existing project was approved by the Chief of Engineers September 23, 1890.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1902, is $667,016.88, of which $142,016.88 was for maintenance of improvement.

The expenditures on this improvement to date have resulted in the construction of the submerged jetty near Fossil Point, under the original project, and in completing the 9,600-foot north jetty, running out to sea from the southern end of the north sand spit, as provided for in the present project.

Since the completion of the north jetty a straight channel through the ocean bar has been maintained having ordinarily a least depth of from 18 to 22 feet at mean low tide.

A comparison of the maps printed in Annual Reports of the Chief of Engineers for 1884 (p. 2264) and for 1900 (p. 4278) will show the improved condition of the bar channel.

The maximum draft that could be carried across the bar at mean low tide June 30, 1902, is about 18 feet. The mean rise and fall of tide on Coos Bay bar is 4.8 feet.

The expenditures during the fiscal year ending June 30, 1902, were limited to caring for the Government plant used in the work of construction in past years.

Inasmuch as the projected depth of 20 feet at low tide was practically obtained in 1895, and has been maintained with but rare exceptions since, by means of the north jetty alone, the necessity for constructing the proposed south jetty is not at this time manifest. The $50,000 appropriated by act of June 13, 1902, will be used for maintaining the present north jetty.

The commerce that crossed the bar at the entrance to Coos Bay consists principally of lumber and coal, originating at points on and adjacent to the bay. Practically all of the commerce is marketed in San Francisco, to which point it is taken by coasting vessels.

The bay and ocean form the only practicable means of transporting the commerce to market.

COMMERCIAL STATISTICS.

	Tons.		Tons.
1883	93,380	1895	128,544
1885	75,718	1896	144,934
1886	109,988	1897	115,896
1890	242,329	1898	103,039
1892	136,065	1899	116,567
1893	109,044	1900	104,294
1894	109,152	1901	97,500

NOTE.—The statistics for 1895–1901 are for calendar years; those prior to 1895 are for the fiscal years ending June 30. Statistics for years not named are either not available or are incomplete.

July 1, 1901, balance unexpended	$10,599.99
Amount appropriated by river and harbor act approved June 13, 1902	50,000.00
	60,599.99
June 30, 1902, amount expended during fiscal year	2,616.31
July 1, 1902, balance unexpended	57,983.68
July 1, 1902, outstanding liabilities	83.00
July 1, 1902, balance available	57,900.68

(See Appendix U U 3.)

4. Coos River, Oregon.—Coos River is the principal tributary of Coos Bay, and empties into the bay at its head, opposite the town of Marshfield. At a point 5½ miles from its mouth the river divides into two branches, known as the North and South forks, up each of which tidal influence extends for about 8½ miles. Before improvement was commenced the small light-draft steamboats and launches plying between Marshfield and the head of tide on each fork experienced considerable difficulty in navigating on account of the many snags, bowlders, etc., in the stream.

A survey of Coos River, Oregon, was made in 1894. (Annual Report of the Chief of Engineers for 1895, pp. 3502–3505.)

The original plan of improvement, based on the survey, proposed the removing of all snags and bowlders from a selected channel way 50 feet wide. It was approved by the Chief of Engineers September 28, 1896. The estimated cost was $5,000.

In the Annual Report of the Chief of Engineers for 1898, page 2967, it was stated that $3,000 in addition to the $5,000 appropriated June 3, 1896, would be required to complete the project.

It was further stated in the Annual Report of the Chief of Engineers for 1900, page 4284, that an appropriation of $1,500 every two years would be required for maintenance.

The amount expended on the project to June 30, 1902, $8,000, resulted in the removal of the obstructing snags and bowlders in the main river and the two forks, so that light-draft steamboats could navigate the stream with greater ease than formerly.

The expenditures during the fiscal year ending June 30, 1902, were in connection with maintaining the improvement.

The maximum draft that could be carried at mean low tide over the shoalest parts of the locality under improvement varied from 1 to 2 feet.

The average rise of tide in the portion of the river between the bay and head of navigation is about 5 feet, which gives ample water for purposes of navigation. Coos River flows through a narrow but productive valley. The commerce, carried on the small boats plying the stream, consists principally of farm and dairy products, which are brought to Marshfield, where ocean vessels touch, for market. On account of the formation of the country the stream is the only means of transporting the commerce to market.

COMMERCIAL STATISTICS FOR CALENDAR YEARS.

	Tons.		Tons.
1896	13,204	1899	[a] 70,007
1897	16,534	1900	[b] 229,225
1898	22,674	1901	62,402

July 1, 1901, balance unexpended	$94.83
Amount appropriated by river and harbor act approved June 13, 1902	2,000.00
	2,094.83
June 30, 1902, amount expended during fiscal year	94.83
July 1, 1902, balance unexpended	2,000.00

(See Appendix U U 4.)

5. Mouth of Siuslaw River, Oregon.—The Siuslaw River empties into the Pacific Ocean at a point about 475 miles north of San Francisco, Cal. It enters the sea through a shifting sand beach, without headlands or other fixed points to mark the entrance, which is obstructed by a shoal outer bar. Before the work of improvement was commenced the channel across this outer bar frequently shifted its position up or down the coast as much as 1 mile, and the depth of water on the bar varied from 5 to 12 feet at low tide.

The original project for improvement, which is also the existing project, was approved by the Secretary of War August 4, 1891 (report printed in the Annual Report of the Chief of Engineers for 1891, pp. 3175–3182), and provides for confining the mouth of the river in the ocean between two high-tide rubblestone jetties, the north jetty to be 7,500 feet long, including a tramway approach at its shore end 3,000 feet long, and the south jetty to be 5,600 feet long, including a tramway approach at its shore end 2,400 feet long. These jetties are designed to hold the channel across the bar in the ocean at the mouth of the river in one position and to maintain the depth of 8 feet at low tide in the bar channel.

The estimated cost of the improvement is $700,000. The charts opposite page 3174 and page 3178 of the Annual Report of the Chief

[a] Includes 21,852 tons of stone for the Government jetty at the entrance to Coos Bay, Oregon.

[b] Includes 170,400 tons of stone for the Government jetty at the entrance to Coos Bay, Oregon.

of Engineers for 1891 show the positions of the proposed jetties. A map of the latest survey of the mouth of the river appears opposite page 4290 of the Annual Report of the Chief of Engineers for 1900.

The amount expended on the existing project to June 30, 1902, $151,700.83, was for the construction of about 4,090 feet of the north jetty, which includes a tramway approach 3,029 feet long at the shore end of the jetty.

This resulted in somewhat checking the tendency of the bar channel to shift its position as far to the north as often occurred before the work of improvement was commenced.

The expenditures during the fiscal year ending June 30, 1902, were for properly caring for the Government plant used in the construction of the north jetty in past years.

Nothing has been done toward constructing the south jetty; the project provides that the north jetty shall be constructed first, at least in part.

Congress by act of June 13, 1902, appropriated $35,000 for continuing this work, authorized a reexamination and survey of the river at its mouth and of the shoals near Florence, with a view to the adoption of a project which will provide for the commerce concerned at a less cost than the existing project.

The maximum draft that could be carried over the bar at mean low tide on June 30, 1902, was about 7½ feet.

The average range of the tide on the bar is 5.2 feet.

The commerce of the Siuslaw River is limited at present, the country being but thinly settled. There is much timber in the vicinity, and lumber is the principal article of commerce at the present time. It is taken from the river to San Francisco in coasting vessels. The river and ocean form the only means of transporting the commerce to market, there being no railroad in the vicinity.

COMMERCIAL STATISTICS.

	Tons.		Tons.
1892	2,381	1897	2,239
1893	7,000	1898	4,350
1894	8,050	1899	4,907
1895	15,296	1900	18,675
1896	7,184	1901	22,351

NOTE.—The statistics for 1896–1901 are for calendar years; for years prior to 1896 they are for fiscal years ending June 30.

July 1, 1901, balance unexpended	$1,070.47
Amount appropriated by river and harbor act approved June 13, 1902	35,000.00
	36,070.47
June 30, 1902, amount expended during fiscal year	771.30
July 1, 1902, balance unexpended	35,299.17
July 1, 1902, outstanding liabilities	50.00
July 1, 1902, balance available	35,249.17

(See Appendix U U 5.)

6. Yaquina Bay, Oregon.—Yaquina Bay is a small tidal estuary of about 5 square miles area. It lies on the Oregon coast, about 110 miles south of the mouth of the Columbia River. The usual bar exists in the ocean at the entrance to the bay. Prior to improvement the prevailing depth on this bar was only about 7 or 8 feet at low tide, and three distinct channels existed at the entrance to the bay.

The original project for the improvement of Yaquina Bay was approved by the Secretary of War January 14, 1881, and provided a plan for expending the appropriation of $40,000 of act of June 14, 1880, by the building of a short wooden crib jetty on the south side.

The project was amended in 1882 when the amount estimated for the completion of the project was $355,000.

The project was modified again in 1888 and in 1892.

Under the original and modified projects there were constructed a rubblestone jetty running out to sea 3,500 feet long from the south beach and a rubblestone jetty running out to sea about 2,800 feet from the north head.

The total amount expended on the original and modified projects prior to operations under existing project is about $690,000.

The construction of these jetties resulted in closing up two of the three channels formerly existing, in developing the third channel, and in obtaining from 14 to 15 feet of water on the bar at mean low tide, or from 21 to 22 feet at high tide.

As the project called for but 17 feet at high tide it is considered to have been satisfactorily completed.

The existing project was approved by act of Congress of June 6, 1900, and provided for removing a cluster of rocks located about 2,000 feet beyond the sea end of the south jetty, pursuant to the river and harbor act of June 6, 1900, at an estimated cost of $20,000, in accordance with report submitted by a Board of Engineers November 14, 1899 (report printed as House Doc. No. 110, Fifty-sixth Congress, first session, and in Annual Report of the Chief of Engineers for 1900, pp. 4293–4314).

The amount expended on the existing project to June 30, 1902, is $15,073.38.

The expenditures to date have resulted in completing the two jetties provided for by the original and modified projects, as stated above, and in removing the clusters of rocks in the bar channel under the provision of the act of June 6, 1900, to a depth of 12 or 13 feet below mean low tide.

The expenditures made during the fiscal year ending June 30, 1902, were for completing the work of removing the cluster of rocks beyond the sea end of the south jetty.

The maximum draft that could ordinarily be carried during the fiscal year ending June 30, 1902, at mean low tide over the shoalest part of the locality under improvement was about 13 feet.

The average range of the tide is 5.9 feet.

COMMERCIAL STATISTICS.

	Tons.		Tons.
1882	1,830	1892	27,111
1883	1,359	1893	24,767
1884	4,995	1894	23,345
1885	9,951	1895	24,589
1886	6,249	1896	17,883
1887	24,694	1897	15,364
1888	23,431	1898	10,380
1889	32,921	1899	5,990
1890	40,074	1900	691
1891	27,540	1901	576

NOTE.—The statistics for 1882–1894 are for the fiscal years ending June 30; for 1895–1901 they are for calendar years.

July 1, 1901, balance unexpended	$12,904.49
June 30, 1902, amount expended during fiscal year	7,977.87
July 1, 1902, balance unexpended	4,926.62
July 1, 1902, outstanding liabilities	141.00
July 1, 1902, balance available	4,785.62

(See Appendix U U 6.)

7. *Tillamook Bay and Bar, Oregon.*—Tillamook Bay is an indentation of the Oregon coast about 6 miles long by about 3 miles wide, and lies about 50 miles south of the mouth of the Columbia River. The usual bar exists in the ocean at the entrance to the bay, but generally has about 15 feet of water over it at mean low tide. At low tide the bay inside is a succession of sand and mud flats, separated by four channels, which latter shoal to a low-tide depth of but 1 or 2 feet near the east end of the bay. A number of streams empty into the bay from the east. These are mountain streams in their upper portions and tidal sloughs in their lower portions. Coasting vessels drawing up to about 14 feet of water, engaged in transporting lumber from the bay to San Francisco, do not go above Hobsonville, a short distance inside the entrance to the bay.

Tillamook City is on Hoquarten Slough, about 12 miles from the entrance to the bay, and is the distributing point for a very fertile valley lying between the Pacific Ocean and the Coast Range of mountains.

The original project for the improvement of Tillamook Bay was approved by the War Department October 4, 1888, and provided for a survey of the entrance and the improvement of Dry Stocking Bar by building pile dikes. The estimated cost was $5,200.

The expenditures on the original project prior to operations under existing project amounted to $5,700.

The existing project was approved by the Chief of Engineers August 9, 1892, Congress having appropriated $15,000 for that purpose by act of July 13, 1892. It provided for connecting the north and middle channels nearly opposite Bay City, putting in dikes at Junction and Dry Stocking bars, and aimed to obtain a least depth in the channel of 9 feet at mean high tide from Hobsonville up to Tillamook City, at an estimated cost of $100,000, exclusive of the $5,700 of the acts of August 11, 1888, and September 19, 1890, already expended on the original project. (Annual Report of the Chief of Engineers for 1892, pp. 2742–2752.)

The amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1902, is $72,923.29, of which the sum of $5,649.92 was for maintenance of improvement.

The maximum draft that could be carried June 30, 1902, at mean low tide over the shoalest parts of the locality under improvement is between 3 and 4 feet.

The mean range of tide is 6.3 feet.

While a channel of the projected depth has been obtained between Hobsonville and Tillamook City, it will perhaps be necessary to strengthen and extend some of the existing dikes in order to maintain the channel. It may be necessary, also, to do a small amount of dredging occasionally. It is proposed to expend the appropriation of act of June 13, 1902, in maintaining and completing the improvement and in making a survey of the bar with a view of making estimates of the cost of securing channels across it of 15 and 20 feet depth, respectively.

There is considerable timber in the vicinity of Tillamook Bay, as well as fertile valley lands. The lumber is marketed almost exclusively in San Francisco, and the agricultural products are marketed in both San Francisco and Portland. The products are transported from Tillamook Bay to San Francisco and Portland by coasting vessels. There being no railroads in the vicinity at this time, the country is dependent upon the bay and ocean for transporting the products to market.

COMMERCIAL STATISTICS.

	Tons.		Tons.
1889	3,571	1896	25,977
1890	27,427	1897	29,405
1891	28,292	1898	35,885
1892	33,220	1899	36,835
1893	18,316	1900	17,640
1895	29,742	1901	21,147

NOTE.—The statistics for years prior to 1896 are for fiscal years ending June 30; since 1896 they are for calendar years.

July 1, 1901, balance unexpended	$731.31
Amount appropriated by river and harbor act approved June 13, 1902	27,000.00
	27,731.31
June 30, 1902, amount expended during fiscal year	649.92
July 1, 1902, balance unexpended	27,081.39
July 1, 1902, outstanding liabilities	30.00
July 1, 1902, balance available	27,051.39

(See Appendix U U 7.)

8. Upper Columbia and Snake rivers, Oregon and Washington.—The designation "Upper Columbia and Snake rivers, Oregon and Washington," covers the 125 miles of the Columbia River from Celilo, Oreg., up to the mouth of Snake River, at Ainsworth, Wash., and the 145 miles of the Snake River from its mouth up to Asotin, Wash., a small settlement about 5 miles above the town of Lewiston, Idaho.

Both the Columbia and Snake rivers between Celilo and Asotin are more or less obstructed by rock and gravel bars, which cause rapids, the ruling depth over some of which at low water is from 2 to 3 feet, while some (particularly in the 67 miles of the Snake between its mouth and Riparia, Wash.) are impassable at extreme low-water stages. These bars, together with the narrow and crooked channel at many places, render navigation by light-draft steamboats between Celilo and Asotin more or less difficult at some points and dangerous at others.

A formal plan for improving the two streams throughout the 270 miles between Celilo and Asotin has never been adopted by Congress.

The first appropriation for the Upper Columbia was made by act of June 10, 1872.

The Snake River has been surveyed throughout the 140 miles between its mouth and Lewiston, but a continuous survey of the Columbia between Celilo and the mouth of Snake River has never been authorized or made.

From 1872 to 1882 the work of removing obstructions was carried

on with the view of obtaining a low-water channel depth of about 5½ feet in the Columbia between Celilo and the mouth of Snake River, and a low-water channel depth of about 4½ feet in the Snake between its mouth and Lewiston. Owing to the construction of railroads along and adjacent to both streams, and the difficulties of navigating the Snake below Riparia and some portions of the Columbia between Celilo and the mouth of the Snake, steamboats abandoned the stream between Celilo and Riparia for purposes of regular navigation in about 1882. Since then the work of improvement has been confined to the 78 miles of the Snake River between Riparia and Asotin, although Lewiston is at present the head of regular navigation on Snake River.

The expenditures to June 30, 1902, $289,322.70, resulted in removing some of the worst obstructions to steamboat navigation between Celilo and Asotin and in the construction of several dikes to deflect and concentrate the flow over shoals.

The expenditures during the fiscal year ending June 30, 1902, were for properly caring for the Government plant used in the work of improvement in past years.

The existing project approved by Congress by act of June 13, 1902, provides for completing and maintaining the improvement of the Snake River between Riparia and Lewiston in accordance with the project recommended in House Doc. No. 127, Fifty-sixth Congress, second session (see Annual Report of the Chief of Engineers for 1901, pp. 3525–3544), and for the improvement of the Snake River above Lewiston.

The estimated cost of the existing project of improvement between Riparia and Lewiston is $23,000, with $5,000 additional for maintenance for two years.

No estimate or detailed project has been made for improvement of the Snake River above Lewiston.

No expenditures have as yet been made under the existing project. The maximum draft that could be carried at mean low water during the fiscal year ending June 30, 1902, over the shoalest point in Snake River between Riparia and Lewiston (the limits of regular navigation) was about 4½ feet. The river is subject to very high rises, varying from 18 to 26 feet, commencing early in May and lasting until September; there is also usually an autumn rise in November varying from 4 to 10 feet.

The principal commerce of the Upper Columbia and Snake river country is wheat. The wheat is taken to Riparia by steamboats, transferred at Riparia to cars, and transported by rail to Portland, Oreg., where it is placed aboard ocean vessels for export to Europe and Asia. It is not expected that the commerce handled on the rivers between Celilo and Asotin will materially increase until some feasible plan is adopted by Congress for passing steamboats around the obstructions in the 12 miles of the Columbia River between Celilo and The Dalles, Oreg., and thus give, during a portion of each year at least, an all-water route of transportation from Asotin to the Pacific Ocean, a distance of about 468 miles. For information in detail concerning the immense territory drained by and tributary to the Columbia and Snake rivers, the commerce of the country, and the present means for transporting it, attention is particularly invited to House Doc. No. 228, Fifty-sixth Congress, second session (printed also in Annual Report of the Chief of Engineers for 1901, pp. 3501–3525).

COMMERCIAL STATISTICS.

	Tons.		Tons.
1875	18,230	1895	37,100
1879	65,975	1896	25,977
1884	30,260	1897	31,531
1891	31,400	1898	36,923
1892	19,167	1899	45,654
1893	19,364	1900	35,920
1894	9,902		

NOTE.—The above statistics since 1896 are for the calendar years; for years prior to 1896 they are for fiscal years ending June 30. Statistics for years not named are not available.

July 1, 1901, balance unexpended	$297.41
Amount appropriated by river and harbor act approved June 13, 1902	40,250.00
Transferred from "Improving Clearwater River, Idaho," by act of June 13, 1902	12,294.41
	52,841.82
June 30, 1902, amount expended during fiscal year	297.41
July 1, 1902, balance unexpended	52,544.41

(See Appendix U U 8.)

9. Columbia River at Three-mile Rapids, Oregon and Washington.—Vessels drawing 23 feet of water easily ascend the Columbia River from its mouth in the Pacific Ocean to the mouth of the Willamette River, a distance of about 98 miles, and river steamers drawing about 8 feet of water navigate the Columbia up to the town of The Dalles, Oreg., a further distance of about 88 miles. Between the towns of The Dalles and Celilo, Oreg., 12 miles, navigation is completely obstructed at all times by rapids and strong currents caused by falls, the steep slope of the river, and the gorged character of the channel.

From Celilo up to the foot of Priest Rapids, in the southern portion of Douglas County, Wash., 198 miles, the Columbia is navigable for boats drawing 3½ to 4½ feet, although with some difficulty at low-water stages on account of rocks and shoals. The Snake River, which empties into the Columbia at Ainsworth, Wash., 125 miles above Celilo, is navigable for light-draft boats up to Asotin, Wash., 145 miles above Ainsworth, although the 67 miles between Ainsworth and Riparia, Wash., are not navigable during the lower stages. There is, therefore, 384 miles of the Columbia between its mouth in the Pacific Ocean and the foot of Priest Rapids, and 145 miles of the Snake River next above its mouth, or a total of 529 miles, which are navigable throughout during at least a portion of each year, while in all that distance there is but 12 miles where navigation is totally obstructed. These 12 miles consist of the Columbia River between The Dalles and Celilo, Oreg. In these 12 miles are four principal obstructions. They are known as Three-mile Rapids, Five-mile (or The Dalles) Rapids, Ten-mile Rapids, and Celilo Falls.

The act of Congress of August 18, 1894, provided for the improvement of Three-mile Rapids and for the construction and equipment of a boat railway from the foot of Five-mile (or The Dalles) Rapids to the head of Celilo Falls, at an estimated cost of $2,264,467.

The expenditures to June 30, 1901, $35,568.49, resulted in a survey of the line of the proposed boat railway, in acquiring title to a part of the land required for it, in partially preparing the necessary plans for the boat railway and its appurtenances, and in making a survey of the

river between The Dalles and Celilo, with the view of overcoming the obstructions by means of canals and locks, this latter survey having been called for by act approved June 6, 1900. Report of the latter survey is printed in House Doc. No. 228, Fifty-sixth Congress, second session (also in Annual Report of the Chief of Engineers for 1901, pp. 3501–3525), to which attention is invited for information concerning the immense territory drained by the Columbia and Snake rivers and streams tributary to them.

The small amount expended during the fiscal year ending June 30, 1902, was in connection with the survey between The Dalles and Celilo, made during the summer and fall of 1900.

Work was suspended on this project until Congress determined whether the construction of a boat railway should continue or some other form of improvement be adopted.

By act of June 13, 1902, Congress approved the project of improving the Columbia River between the foot of The Dalles Rapids and the head of Celilo Falls, Oregon and Washington, by means of a canal, and the improvement of the channel of the river in accordance with the project submitted in House Doc. No. 228, Fifty-sixth Congress, second session, at the same time authorizing the unexpended balance heretofore appropriated for securing rights of way and commencing the construction of a boat railway to be used for the canal and other improvements contemplated in the new project. The estimated cost of the existing project is $3,969,371, but Congress has provided that before entering upon the work an examination be made by a Board of Engineers with a view to modifying the project in such a way as to diminish the cost thereof.

July 1, 1901, balance unexpended	$214,579.26
June 30, 1902, amount expended during fiscal year	147.75
July 1, 1902, balance unexpended	214,431.51
Amount (estimated) required for completion of existing project	Indefinite.
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	100,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix U U 9.)

10. Canal at the Cascades, Columbia River, Oregon.—In passing through the Cascade Mountain Range the channel of the Columbia River for the distance of about 4½ miles (see map opposite p. 2246, Annual Report of the Chief of Engineers for 1884) is so contracted in width that that portion of the stream partakes of the nature of a gorge. In the upper 2,500 feet of this gorge (shown in photograph No. 409, following p. 3224, Annual Report of the Chief of Engineers for 1899) there is a fall of about 24 feet at low water, which, on account of the rapids and huge bowlders, can not be navigated. Throughout the lower portion of the gorge, about 4 miles, the channel, while not as contracted nor of as steep slope as the upper 2,500 feet, is nevertheless so contracted and of such slope that rapids are formed that can not be navigated at the higher stages. This lower portion of the gorge, also, was originally much obstructed by large bowlders and reefs.

The original project for a canal around the Cascades of the Columbia River, at an estimated cost of $2,544,545, was approved by the Secretary of War October 12, 1877.

It was modified in 1880 (Board of Engineers, November 13, 1880) and 1886 and in April, 1888 (printed in Annual Report of the Chief of Engineers for 1889, pp. 2551–2559), and provides for the construction of a canal for the passage of the Cascades and for the improvement of the rapids below, to secure a low-water channel depth of 8 feet.

Under this project work was prosecuted on a canal about 3,000 feet long on the Oregon shore, around the upper or principal rapids at the Cascades, and a lock in the canal 462 feet long, 90 feet wide, and designed for an extreme low-water draft of 8 feet. Also many obstructing rocks and reefs in the rapids below the canal and lock were removed.

There has been expended on the original and modified projects prior to operations under existing modified project the sum of $3,593,900.

The existing modified project was adopted in 1894. (Report of Board of Engineer officers of October 18, 1894, printed in Annual Report of the Chief of Engineers for 1895, pp. 3571–3582.) It provides for utilizing 462 feet of the incomplete canal above the upper lock gates as a second lock, by putting in a concrete floor and the necessary side walls. This modification also provides for raising the protection works of the canal, the height of which had been based on the flood of 1876, the highest water known previous to 1894, to make them conform to the flood level of the latter year, which was 6 feet above that of 1876.

The estimated cost of the existing modified project was $413,360 additional. It was approved by the act of June 3, 1896, making an appropriation of $50,000 therefor.

The amount expended on the work of the original and modified projects up to the close of the fiscal year ending June 30, 1902, is $3,746,065.42.

Congress by act of June 13, 1902, appropriated $30,000 for continuing improvement, provided that as much of said appropriation as may be necessary may be used in the removal of the obstructive rock in the rapids of the Columbia River near the Cascades locks.

There has been a total of $3,778,000 appropriated for this work, and the amount (estimated) required to be appropriated for its completion is $229,260, thus making the estimated total cost $4,007,260.

The expenditures up to June 30, 1901, resulted in the construction of the canal and locks, as projected, to a point where navigation through them is permitted. Although incomplete, the works were opened to navigation on November 5, 1896, and have been used since that time by boats, except when high water made it impracticable.

The maximum draft that could be carried through the locks during low-water stage of the fiscal year ending June 30, 1902, is about 7 feet. The yearly rise in the Columbia takes place in May, June, or July; it generally subsides by November, and its usual height above extreme low water is about 40 feet.

The expenditures during the fiscal year ending June 30, 1902, were principally for caring for the Government plant used in constructing the canal and locks in past years, and for materials for fenders in the incomplete upper lock, which are designed to enable boats to use the canal and locks at stages up to 6 feet higher than the incomplete works permitted.

The commerce that has passed through the canal is as follows:

	Freight.	Passengers.
	Tons.	*Number.*
1898	18,812	30,327
1899	16,700	23,908
1900	17,710	30,639
1901	22,426	34,762
1902	19,710	52,720

NOTE.—The above statistics are for fiscal years ending June 30.

July 1, 1901, balance unexpended	$5,646.73
Amount appropriated by river and harbor act approved June 13, 1902	30,000.00
	35,646.73
June 30, 1902, amount expended during fiscal year	3,712.15
July 1, 1902, balance unexpended	31,934.58
July 1, 1902, outstanding liabilities	867.33
July 1, 1902, balance available	31,067.25

(See Appendix U U 10.)

11. Operating and care of canal and locks at the Cascades of the Columbia River, Oregon.—The obstructions in the Columbia River at the Cascades are described in the preceding report. The canal and locks, which pass steamboats around these obstructions, were opened to navigation on November 5, 1896, although incomplete in many details, and have been in condition to be used ever since that date, with the exception of a few days when minor repairs were in progress.

The expenditures up to June 30, 1901, $24,382.17, were in payment of salaries of employees engaged in operating and caring for the canal and locks, for a new valve for the main culvert on the south side of the lower lock, and for partially repainting the steel lock gates.

The expenditures during the fiscal year ending June 30, 1902, amounting to $10,881.33, were in payment of salaries of employees engaged in operating and caring for the canal and locks, in continuing the work of repainting the steel lock gates, and in dredging deposit from the upper entrance to the canal under a contract dated October 9, 1901.

(See Appendix U U 11.)

12. Columbia River, between Vancouver, Wash., and the mouth of Willamette River.—The city of Vancouver, Wash., is located on the Columbia River about 103 miles above its mouth and 5 miles above the mouth of the Willamette River in the Columbia. Vessels drawing up to about 23 feet of water ascend the Columbia from its mouth up to a point 2½ miles below Vancouver, where there is a bar which had originally but 9 feet of water over it.

The project, adopted in 1892 (reports printed in Annual Reports of the Chief of Engineers for 1892, pp. 2865–2869, and for 1896, pp. 3264–3265), provides for constructing a pile, brush, and rubblestone dike about 3,000 feet long from the Oregon shore to the head of Hayden Island, opposite Vancouver, at an estimated cost of $100,000, to stop the flow south of the island during low-water stages and deflect it down the main channel north of the island, so as to scour the bar below Vancouver and obtain a depth over it sufficient to permit ascending

vessels drawing 20 or more feet to reach Vancouver. It was approved by the Chief of Engineers August 6, 1892.

On June 18, 1901, the additional sum of $8,000 was allotted from the appropriation of June 6, 1900, for emergencies in river and harbor works, to be applied to repairing the dike during the low-water period of the winter of 1901–2.

The expenditures to June 30, 1902, were $107,763.34, of which $22,230.18 was for maintenance, and resulted in completing the dike and in revetting the head of Hayden Island to prevent erosion. The map following page 3230 of the Annual Report of the Chief of Engineers for 1899 shows the work as completed May 2, 1899.

The expenditures during the fiscal year ending June 30, 1902, amounting to $7,800.34, were for maintenance of the improvement, small quantities of brush and rubblestone being placed in the dike and on the head of Hayden Island to compensate for settlement caused by the all-summer high water of 1901. These materials were purchased and placed in the work under a contract dated November 8, 1901.

Soundings made in December, 1901, showed that an increase of about 1 foot in the depth on the obstructing bar had been obtained as the result of the effect of the dike, the depth on the bar at that time being about 10 feet.

The maximum draft that could be carried at extreme low water during the past year was about 10 feet.

The average range of tide in the Columbia River at Vancouver at extreme low stage is about 0.8 of a foot. During the summer freshet in May and June the usual rise is about 20 feet.

July 1, 1901, balance unexpended	$8,038.00
Amount appropriated by river and harbor act approved June 13, 1902	2,000.00
	10,038.00
June 30, 1902, amount expended during fiscal year	7,800.34
July 1, 1902, balance unexpended	2,237.66

(See Appendix U U 12.)

13. Clearwater River, Idaho.—This stream empties into the Snake River at Lewiston, Idaho. It is a mountain stream, with steep slope and many rapids, the average fall of the stream from Kamiah, Idaho, down to Lewiston being about 7 feet per mile.

The original project for improvement, adopted in 1879, provided for removing rocks from the channel to obtain a low-water depth of 4½ feet, for small steamboats, in the 40 miles next above Lewiston, at an estimated cost of $34,424.

The sum of $15,000 was expended on the original project for removing some of the rocks which obstructed low-water navigation.

The existing modified project, approved by the Secretary of War July 23, 1897, provides for improving the 75 miles of the stream next above Lewiston for high-water navigation, by removing obstructions, at an estimated cost of $35,000, exclusive of the $15,000 appropriated prior to 1883.

The amount expended on the original and modified projects to June 30, 1902, is $37,646.09.

The expenditures made under the existing modified project were for removing some of the worst obstructions to high-water navigation

from Kamiah, 67 miles above Lewiston, down to Big Eddy, 27 miles above Lewiston.

The officer in local charge of the improvement reported that the construction, several years ago, of a branch of the Northern Pacific Railroad, paralleling the stream at all points between Lewiston and Kamiah, and affording ample transportation facilities for the somewhat limited commerce of the region, and the difficulties and dangers connected with navigating the stream, caused steamboats to abandon the river. These conditions were reported to the Secretary of War July 6, 1899, who authorized, July 8, 1899, that the appropriation of $10,000, of March 3, 1899, be held in the Treasury to await further developments regarding the necessity for further improving the stream.

Congress, by act approved June 13, 1902, has made available for the improvement of the Upper Columbia and Snake rivers, Oregon and Washington, the unexpended balance of the appropriation heretofore made for the improvement of the Clearwater River, amounting to $12,294.41.

The expenditures in fiscal year ending June 30, 1902, were for maintenance of improvement, in connection with properly caring for the Government plant used in the work of improvement in former years.

The stream has not been visited by a steamboat during the past two years. The usual freshet occurs in June, with an average rise of 10 or 12 feet above extreme low water.

July 1, 1901, balance unexpended	$12,754.82
June 30, 1902, amount expended during fiscal year	398.41
July 1, 1902, balance unexpended	12,356.41
July 1, 1902, outstanding liabilities	62.00
July 1, 1902, balance transferred to improving Upper Columbia and Snake rivers, Oregon and Washington, by act of June 13, 1902	12,294.41

(See Appendix U U 13.)

IMPROVEMENT OF WILLAMETTE RIVER, AND OF COLUMBIA RIVER BELOW THE MOUTH OF THE WILLAMETTE, AND THEIR TRIBUTARIES, OREGON AND WASHINGTON.

This district was in the charge of Capt. W. C. Langfitt, Corps of Engineers. Division Engineer, Col. Jared A. Smith, Corps of Engineers, to September 23, 1901; Lieut. Col. D. P. Heap, Corps of Engineers, from September 23 to September 30, 1901, and Lieut. Col. W. H. Heuer, Corps of Engineers, since September 30, 1901.

1. Long Tom River, Oregon.—The Long Tom River is a tributary of the Willamette. It rises on the eastern slope of the Coast Range, drains an area of about 430 square miles, including a large amount of very productive valley land, and empties into the Willamette River 122 miles distant from Portland by river.

Before improvement the river was almost impassable on account of the numerous brush-covered shoals and overhanging trees. It is very narrow and runs so low during the spring and summer that scarcely 6 inches of water is found on the bars, but during the winter or rainy season a depth of 5 or 6 feet is found, and the improvement was intended to furnish relief during the periods of the year when high water prevails.

The present project (see Annual Report of the Chief of Engineers for 1898, p. 3045) for improvement was adopted in 1898. It provided for the removal of snags, overhanging trees, etc., with a view to obtaining a channel for high-water navigation during a few months in the rainy season. This project was satisfactorily completed in 1900.

The river and harbor act of March 3, 1899, transferred $3,000 from funds previously appropriated for improvement of Willamette and Yamhill rivers to this work. All of this amount was expended during the fiscal year ending June 30, 1900.

The completion of the project afforded high-water navigation during the seasons of 1900 and 1901 for the transportation of 300 and 275 tons of produce, respectively, for those years. This traffic, however, has not been as large as anticipated, as during the last season no advantage was taken of the improvement. Owing to this reason and to the uncertainty of any great benefit derived from previous expenditures, no further work is deemed necessary at present.

The river and harbor act of June 13, 1902, allows $500, or so much thereof as may be necessary, from appropriation for improving Willamette and Yamhill rivers, to be applied to maintenance of this stream, which it is proposed to expend in snagging should the interests of commerce and navigation demand it. This will therefore be submitted as final report under improving Long Tom River, Oregon, and reports of future operations will be made under improving Willamette and Yamhill rivers. No money statement is submitted, as no money was available, the funds provided by act of June 13, 1902, being included in statement for improving Willamette and Yamhill rivers.

(See Appendix V V 1.)

2. Willamette River above Portland, and Yamhill River, Oregon.—The Willamette River rises in the Cascade Range, about 150 miles southward of the Columbia River, and flows northerly, generally parallel and about 50 miles east of the coast line. It enters the Columbia about 105 miles above its mouth and 12 miles north of the city of Portland.

The Yamhill River rises in the Coast Range, flows in a northeasterly direction, and enters the Willamette about 40 miles above its mouth.

A detailed description of the Willamette River, together with that of its condition prior to improvement, may be found in the Annual Reports of the Chief of Engineers for 1876, page 654, and for 1880, page 2280.

The Yamhill River drains an exceedingly fertile valley, which has been settled for years. Prior to improvement the channel was obstructed by snags and rocks, which were removed under the project of 1892, and boats could then reach Dayton (about 5 miles) at all seasons on a draft of about 2½ feet. Above Dayton and about 1 mile below Lafayette the channel was obstructed by rapids, so that boats could reach Lafayette (9 miles) and McMinnville (about 18 miles) only during extreme high water.

The original project for improvement of the Willamette was adopted in 1870 and modified in 1878 and 1879, and in 1892 was extended to include the removal of obstructions in the Yamhill River to McMinnville.

On the above project $247,747.51 has been expended.

The project of 1896 (Annual Report of the Chief of Engineers for 1896, p. 3310) provided for the improvement of the Willamette River

from Portland to Eugene, at an estimated cost of $131,697, and on the Yamhill (see Annual Report of the Chief of Engineers for 1895, p. 3602) provided for the removal of obstructions and the construction of a lock and dam in the Yamhill River to obtain a draft of 3½ feet from the mouth of the river to McMinnville; estimated cost, $69,000. On the project of 1896 there was expended, up to June 30, 1902, the sum of $202,620.69, of which amount $5,421.22 was applied to maintenance.

The construction of controlling works under the old project has, without doubt, afforded relief and alone made navigation possible during recent years. However, it is believed that the physical features of the river are such that the depths proposed by the project can not be obtained at reasonable cost.

The river and harbor act of June 13, 1902, appropriates $68,000 for continuing improvement and allows $500, or so much thereof as may be required, for maintenance of improvement of Long Tom River. As recommended in previous annual report, it is proposed to apply these funds to the construction of a dredging plant to aid in creating and maintaining such depths as may be reasonable and practicable, snagging, and the construction of controlling works at places where they will be of greatest benefit. This is practically a continuation of previous operations with the addition of a dredging plant to aid the work below Corvallis, and confining operations above Corvallis to snagging for aid to high-water navigation.

Aside from the expenditures made during the fall of 1900 from allotment of $5,000 from the emergency act of June 6, 1900, and removal of some snags and drift near Corvallis last November, no work has been done on the Willamette since May, 1900, owing to lack of funds. The river is therefore more or less obstructed by snags, but boats are now running to Corvallis on a draft of 3 feet, with the gauge at the latter place reading 4 feet above low water. It is hoped that with removal of snags and some dredging boats may reach Independence throughout the low-water season. On the Yamhill some little snagging was done during the year, and boats are running regularly to McMinnville through the lock completed in 1900, near Lafayette.

The water levels vary according to height of the winter freshets, which in 1891 reached 30 feet above low water at Salem, Oreg.

The additional work proposed is for the purpose of affording better facilities for navigating the portions of river under improvement, as an extension of benefits is not contemplated.

The volume of commerce affected is shown by the appended comparative statement of traffic handled. This tonnage consists of grain, farm and lumber products shipped to market, and machinery and supplies distributed.

Comparative statement of tonnage carried by river boats on the Willamette River above Portland.

Calendar year.	Merchandise.	Passengers.	Calendar year.	Merchandise.	Passengers.
	Tons.	*Number.*		*Tons.*	*Number.*
1894	74,615	56,368	1898	112,154	67,524
1895	130,870	57,376	1899	117,782	50,738
1896	218,480	48,465	1900	182,458	47,324
1897	186,621	87,960	1901	191,901	103,971

July 1, 1901, balance unexpended	$940.70
Amount appropriated by river and harbor act approved June 13, 1902	68,000.00
	68,940.70
June 30, 1902, amount expended during fiscal year	808.90
July 1, 1902, balance unexpended	68,131.80
July 1, 1902, outstanding liabilities	61.00
July 1, 1902, balance available	68,070.80

(See Appendix V V 2.)

3. Operating and care of lock and dam in Yamhill River, Oregon.—The Yamhill lock is situated on Yamhill River near Lafayette, Oreg., about 8 miles above its junction with the Willamette and some 10 miles below the town of McMinnville, the head of steamboat navigation. The lock was completed under contract in September, 1900.

The funds for repairs, made necessary by freshets during the winter of 1900–1901 and for operating expenses during the fiscal year 1902, were provided by allotment of May 24, 1901, the amount allotted being $23,200.

The total amount expended under allotments for operating and care, including repairs, is $24,992.67, of which amount $22,479.27 was expended during the fiscal year 1902.

The repairs of damage caused to the slopes and revetments and reported in last annual report were practically completed, and the lock has been operated almost continuously except for 78 days between November 23, 1901, and March 25, 1902, when high water prevented.

The total traffic passed through the lock during the year amounted to 2,455 tons of miscellaneous freight and 1,199 passengers.

(See Appendix V V 3.)

4. Columbia and Lower Willamette rivers below Portland, Oreg.—The Columbia River is the great river of the Pacific coast. It rises in British Columbia, flows southerly and westerly, and forms in its lower portions for 330 miles the boundary between Oregon and Washington, emptying into the Pacific Ocean between these two States.

The Willamette River rises in the Cascade Range, about 150 miles southward of the Columbia River, flows northerly, entering the Columbia about 105 miles above its mouth and 12 miles north of the city of Portland.

The portions of these rivers covered by this improvement include the 12 miles of the Willamette between Portland and its mouth and 98 miles of the Columbia from the mouth of the Willamette to the sea.

The original condition of these rivers from Portland to the sea was such that only from 10 to 15 feet could be carried over the shoal places at low water. Numerous sand bars obstructed navigation to deep-water craft and distributed the water over an extended area, so that the channels were comparatively narrow.

The value and the availability of this waterway for purposes of commerce is proved by the quantities of grain and produce that through it find an outlet to the markets of the world from Oregon, Washington, and Idaho. Its improvement to navigation for deep-water craft is of the utmost importance to the entire northwest section of the country, whose inhabitants find the natural outlet for their produce through the valley of the Columbia.

Prior to adoption of a project dredging had been done for temporary relief and the sum of $221,780.46 expended for that purpose.

The original project was adopted in 1877 and was prepared by the Board of Engineers for the Pacific coast with a view of obtaining a channel depth of 20 feet. In 1891 (Annual Report of the Chief of Engineers for 1892, p. 2850) the project was extended to obtain a low-water channel depth of 25 feet at an estimated cost of $772,464, and the Port of Portland Commission, a corporation existing under the laws of the State of Oregon, was granted permission to assist in carrying it into execution. On the original and modified project, exclusive of amounts expended in dredging prior to 1877 and by the Port of Portland Commission, there has been expended the sum of $1,080,874.11 to June 30, 1902, and it may be said that all the expenditures since 1895 have been applied to maintenance, as no permanent works have been constructed.

The existing project, adopted by the act of June 13, 1902 (see Annual Report of the Chief of Engineers for 1900, p. 4418 et seq.), is based on survey authorized by act of March 3, 1899, and proposes a 25-foot channel to the sea by construction of controlling works and dredging. Estimated cost, $2,796,300, with $175,000 as cost of a new dredge and accessories and $50,000 for maintenance.

The sum of $225,000 has been appropriated by act of June 13, 1902, which is insufficient to allow the construction of the proposed dredge, make necessary repairs to present plant, pay operating expenses for both dredges, and construct any permanent works. In view of this it is proposed to apply the funds to operating the new dredge of the port of Portland, if satisfactory arrangements can be made, and in making repairs to and operating the United States dredge.

Dredging has been the only work done during the year, a total of 507,953 cubic yards being excavated at various shoal places.

Operations of the Port of Portland Commission have also been confined to dredging during such times as their plant was not being repaired and the Commission reports having excavated 872,318 cubic yards, with a total expenditure of $151,827.17.

Since the commencement of improvement the channel depth between Portland and Astoria has been increased 5 feet, with a good navigable width. The maximum draft that could be carried on June 30, 1902, at mean low water over the shoalest part of the river was about 19 feet. The usual variation of water levels due to tides is from 2 feet at Portland to 7 feet at Astoria. The variation caused by freshets ranges from 20 feet at Portland to zero at Astoria.

Comparative statement of traffic.

Calendar year.	Handled by river craft.	Foreign and coastwise to and from Portland.	
		Receipts.	Shipments.
	Tons.	*Tons.*	*Tons.*
1893	1,310,866		312,790
1894	1,347,155	52,272	340,792
1895	1,040,022	40,238	395,954
1896	1,129,673	49,011	329,102
1897	1,499,337	47,345	290,412
1898	1,121,161	27,776	488,818
1899	1,489,708	36,253	836,134
1900	1,287,582	32,905	489,385
1901	1,534,780	29,548	639,736

July 1, 1901, balance unexpended	$74,553.81
Amount appropriated by river and harbor act approved June 13, 1902	225,000.00
	299,553.81
June 30, 1902, amount expended during fiscal year	46,841.62
July 1, 1902, balance unexpended	252,712.19
July 1, 1902, outstanding liabilities	2,939.67
July 1, 1902, balance available	249,772.52

(See Appendix V V 4.)

5. Columbia River, Oregon, below Tongue Point.—This improvement covers a stretch of the river about 5½ miles long, beginning just below Tongue Point and extending down along the water front of Astoria. The principal obstruction is a rocky point known as the Sylvia de Grasse Reef, about 1 mile below Tongue Point, and around which ships are obliged to make a short turn to avoid striking it. The ledge induces shoaling, with consequent narrowing of the passage.

The original and present project, adopted in 1896 (Annual Report of the Chief of Engineers for 1895, pp. 3605–3608), contemplates the removal of the wreck of the *Sylvia de Grasse* and the outer portion of the reef, supplemented by dredging to obtain a 25-foot channel, 250 feet in width, extending along the water front of Astoria. Estimated cost, $121,550.

The amount expended on this work up to the close of the fiscal year ending June 30, 1902, was $71,105.86. Prior to operations under the present contract no work had been done except dredging for temporary relief.

Under date of October 20, 1900, a contract for excavating rock and sand was entered into. Work began in January, 1901, and has been in progress throughout the year, except when suspended for repairs or on account of stormy weather. During the year 8,246 cubic yards of rock and 3,321 cubic yards of sand were excavated, and it is estimated that the whole work will be completed in about two months. The result of this work has been the attainment of a depth of 24 feet over a channel about 150 feet wide, and with very little dredging in a few shoal places this will be increased to 25 feet.

The usual variation of tide is about 6½ feet.

For commercial statistics see report on improving Columbia and Lower Willamette rivers below Portland, Oreg.

July 1, 1901, balance unexpended	$100,982.26
June 30, 1902, amount expended during fiscal year	51,088.12
July 1, 1902, balance unexpended	49,894.14
July 1, 1902, outstanding liabilities	6,819.05
July 1, 1902, balance available	43,075.09
July 1, 1902, amount covered by uncompleted contracts	14,055.00

(See Appendix V V 5.

6. Mouth of Columbia River, Oregon and Washington.—Prior to commencing the work of construction, in 1885, there were from one to three channels across the bar at the mouth of Columbia River, and these channels varied both in location and depth, the latter being usually from 19 to 21 feet, while the location shifted through nearly 180

degrees from Cape Disappointment to Point Adams. A map of this locality before improvement is printed in the Annual Report of the Chief of Engineers for 1886, page 1978.

The project for improvement adopted in 1884 (Report of Board of Engineers, Annual Report of the Chief of Engineers for 1883, p. 2012 et seq.) contemplated securing a low-water channel depth of 30 feet across the bar at the mouth of the river by the construction of a jetty to extend from the shore near Fort Stevens across Clatsop Spit in the direction of a point about 3 miles south of Cape Disappointment, the jetty to be built of rubble and random blocks of large size, resting upon mattresses of brush.

The original project, adopted in 1884, provided for a single jetty on the south side of the entrance, built to low-water level and about 4½ miles long. This was modified in 1893 (Annual Report of the Chief of Engineers for 1893, p. 3489 et seq.) to provide for practically a high-tide jetty, in which was included the construction of four low groins built out from the main jetty. The estimated cost of the jetty in the original project was $3,710,000.

The jetty was completed in 1895 to the length of 4½ miles and full projected height, with four low-tide groins, 1,000 feet, 1,000 feet, 600 feet, and 500 feet long, respectively. Map showing completed work is printed in the Annual Report of the Chief of Engineers for 1895, page 3560. This work caused an increase in depth over the bar from 20 to to 31 feet at mean lower low water from 1885 to 1895.

Annual surveys since 1896 have shown each year marked shoaling of the depths over the bar, the greatest depth obtained having been 31 feet in 1895, being 1 foot in excess of the depth proposed by the original project.

A detailed survey was made in 1899, and report submitted by the district officer under date of November 6, 1899, with project and estimate for deepening the channel to 40 feet, at a cost of $2,531,140.51. The report is printed in House Doc. No. 94, Fifty-sixth Congress, first session, and also in Annual Report of the Chief of Engineers for 1900, Part VI, page 4430 et seq., to which attention is invited for further details, maps, etc.

This project was adopted by sundry civil act of June 6, 1900, and the sum of $250,000 was appropriated thereby for repair of the jetty, including repairs to wharves, approaches, tramway, plant, quarters and buildings, and contingent expenses. The river and harbor act of June 13, 1902, makes a further appropriation of $500,000 for continuing improvement, and authorizes contracts not exceeding $1,000,000

The amount expended on the projects of 1884 and 1893 was $1,968,-753.14; on the present project $233,474.47 has been expended, making a total of $2,202,227.61 to June 30, 1902.

Work during the past year has been carried on with a view to facilitating early operations under additional appropriations. The washed-away portions of the jetty tramway had been redriven during July and August, and 19,794 tons of stone dumped to preserve it. Part of this new work was carried away during the winter storms. The standing portion of the tramway is in good repair. All available plant has been thoroughly overhauled and put in good condition. It is considered, however, that it is now too late in the season to attempt further extension of the jetty before next spring.

This year's survey, completed June 26, 1902, shows a still further shoaling of the north channel, with a depth through it of 21 feet, while on the south, or Clatsop Spit, there is a general increase in depth of 2 to 3 feet. There is also evidence of the north channel closing and one forming in a westerly direction, and it is hoped with somewhat increased depth. The 24 and 30 foot contours of the bar have receded considerably on its westerly or sea side. Sand Island and Clatsop Spit show very few changes from last year's conditions, but the depth at the harbor's throat has increased by about 10 feet, the maximum depth now being 85 feet.

The average rise and fall of tide on the Columbia River Bar is about 7.4 feet.

For commercial statistics see report on improving Columbia and Lower Willamette rivers below Portland, Oreg.

July 1, 1901, balance unexpended	$96,183.24
Amount appropriated by river and harbor act approved June 13, 1902.	500,000.00
	596,183.24
June 30, 1902, amount expended during fiscal year	72,728.85
July 1, 1902, balance unexpended	523,454.39
July 1, 1902, outstanding liabilities	3,244.59
July 1, 1902, balance available	520,209.80
Amount (estimated) required for completion of existing project	1,776,181.46
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	550,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix V V 6.)

7. *Clatskanie River, Oregon.*—The Clatskanie River rises in the Coast Range and is a tributary of the Columbia, which it enters by means of connecting sloughs at a point on the south bank about 65 miles below Portland.

At the time of the adoption of the present and original project (Annual Report of the Chief of Engineers for 1898, p. 3050) a depth of 5 feet could be carried to Clatskanie, except over a shoal near the latter place, where but 2 to 3 feet is found. Large quantities of lumber and shingles find a market through this natural outlet. The channel is very narrow and exceedingly winding.

The river and harbor act of March 3, 1899, appropriated $13,000, being the total estimated cost of completing the improvement. The project submitted for its expenditure and approved by the Secretary of War May 27, 1899, provided for cutting a short channel across the bend immediately below Manzanillo and another from the bend above this point to the first bend below the town of Clatskanie, and by dredging below the latter point, the work to be done by contract. It was expected to secure thereby a depth of 6 feet to the town of Clatskanie, 3 miles from the mouth.

The amount expended on this work up to the close of the fiscal year ending June 30, 1902, was $9,918.02, none of which was applied to maintenance. The project was completed in February, 1902, under contract dated June 28, 1901, for dredging, a total of 55,864 cubic yards of material being excavated, as against an estimated amount of

56,000 cubic yards. The completion of the project affords better facilities for navigation to the town of Clatskanie by shortening the distance and avoiding the large bend in the old channel, and by an increased depth of about 2 feet.

The maximum draft that can be carried over the shoalest place at low water to the town of Clatskanie is 5 feet. The usual variation of levels of water surface is about 5 feet due to tides and about 10 feet during freshets.

Comparative statement of the tonnage carried by river boats on the Clatskanie River for past six years.

Calendar year.	Merchandise.	Passengers.	Calendar year	Merchandise.	Passengers.
	Tons.	*Number.*		*Tons.*	*Number.*
1896	117,242	8,460	1899	68,126	5,210
1897	112,803	11,545	1900	88,622	5,305
1898	153,257	12,250	1901	51,967	2,136

July 1, 1901, balance unexpended	$12,588.47
June 30, 1902, amount expended during fiscal year	9,506.49
July 1, 1902, balance unexpended	3,081.98

(See Appendix V V 7.)

8. Cowlitz and Lewis rivers, Washington.—(a) Cowlitz River.—The Cowlitz River rises in the Cascade Range, and flows into the Columbia River about 64 miles from its mouth.

Prior to improvement the ruling depth at low water to Toledo, 40 miles above the mouth, was 14 inches. The channel was narrow and tortuous and obstructed by sand bars, numerous snags, drift, logs, etc. The valley is exceedingly fertile, and any improvement of the river is a direct benefit to the farmers, who ship great quantities of produce to market by boat.

The original project, adopted in 1880 (report dated December 15, 1879), contemplated the removal of sand bars and other obstructions to a point about 50 miles above the mouth, at a cost of $5,000 for the first year and an annual expenditure thereafter of $2,000 for maintenance.

The amount expended on the work up to the close of the fiscal year 1902 was $31,000, at which time the available funds had been exhausted and no work has since been done.

The conditions are now such that boats ascend to Toledo, the principal difficulty experienced being at the bar below Toledo, where lining over this shoal becomes necessary at low water. Three or four bars below this point are also giving trouble.

No results in the way of increased depths since last report have been attained.

In connection with this improvement it is thought that dredging in the lower tidal reaches will prove advantageous in securing and maintaining depths.

The maximum draft that can be carried over the shoalest part at low water is about 16 inches. The usual range of water level due to tides varies from 4 feet at the mouth to zero about 9 miles upstream. The variations due to freshets in the Cowlitz River are about 22 feet.

Future reports will be made under title of "Improving Cowlitz and Lewis rivers, Washington," as the river and harbor act of June 13, 1902, contains an item providing for their improvement, and it is intended to apply a portion of the amount appropriated to snagging and dike or dam construction, as may appear most necessary.

Comparative statement of traffic.

Calendar year.	Tons.	Calendar year.	Tons.
1894	17,923	1898	16,210
1895	17,940	1899	26,511
1896	14,776	1900	17,279
1897	17,582	1901	14,211

This statement does not include large quantities of logs that are annually floated down this stream.

(*b*) *Lewis River.*—The Lewis River rises in the Cascade Range. It is a tributary of the Columbia, drains an exceedingly fertile valley, and enters the Columbia from the north about 14 miles below the mouth of the Willamette, or 25 miles from Portland, Oreg.

At the time of the adoption of the present and original project (Annual Report of the Chief of Engineers for 1897, p. 3475) 4 feet could be carried at low water to the forks, 3½ miles from the mouth, and 2 feet to Lacenter, on the East Fork and about 7 miles from the mouth. The channel was obstructed by trees, snags, and occasional shoals. Its improvement is of benefit to the farmers and the large adjacent lumbering interests.

The project for improvement of the Lewis River contemplated the removal of snags and obstructions, dike and dam work, and dredging with a view of obtaining a depth of 6 feet in the main river to the forks and 4 feet thence to Lacenter. Estimated cost, $20,460.

The amount expended on the work up to the close of the fiscal year ending June 30, 1902, was $5,646.72, none of which was applied to maintenance.

No work of improvement was done during the past fiscal year, as previous operations had afforded relief and it was not deemed necessary to do anything further until results of previous operations had been fully determined and additional funds were available.

A survey and map were made with a view to making plan for future work. It has developed that dredging at the mouth of the East Fork in 1900 resulted in an increase of nearly 3 feet in the ruling depth over 1,500 feet of the cut. The remaining 350 feet has shoaled to about 2 feet at normal stage.

The conditions on June 30, 1902, were such that boats could reach Lacenter only when the river was at a stage of 3 feet above normal. On lower stages a transfer to smaller boats at the forks is necessary. To the latter point a maximum draft of 5 feet could be carried. The usual variation of the level of water surfaces on account of tides is about 2 feet at the forks and about 1¼ feet at Lacenter. The freshets vary from 15 to 20 feet in height. The lower reaches of this stream are of a tidal nature and bars are formed in the sluggish waters during freshets, which it is believed can best be overcome by dredging.

The river and harbor act of June 13, 1902, appropriated $9,500 for continuing improvement of Cowlitz and Lewis rivers, Washington, including improvement of the North Fork of the Lewis River, and future reports will be made under title of new appropriation, the amount being included in money statement herewith.

The additional work proposed is for the purpose of affording increased depths to Lacenter and such work on the North Fork as may be necessary on examination.

The appended statement shows the volume of commerce involved, and consists of lumber and farming products transported to market and supplies and machinery distributed:

Comparative statement of the tonnage carried by river boats on the Lewis River for the past six years.

Calendar year.	Merchandise.	Passengers.	Calendar year.	Merchandise.	Passengers.
	Tons.	*Number.*		*Tons.*	*Number.*
1896	2,374	12,990	1899	6,549	12,351
1897	3,881	15,306	1900	12,638	14,129
1898	6,303	15,938	1901	17,277	15,582

The above does not include large quantities of logs which are annually floated out of this stream.

July 1, 1901, balance unexpended	$5,376.41
Amount appropriated by river and harbor act approved June 13, 1902	9,500.00
	14,876.41
June 30, 1902, amount expended during fiscal year	1,023.13
July 1, 1902, balance unexpended	13,853.28

(See Appendixes V V 8–9.)

9. Gauging waters of Columbia River, Oregon and Washington.—The object of this gauging is to obtain data for use in connection with the improvement of the river and to supply information to persons interested in its navigation.

The self-registering gauge was reestablished at Astoria in November, 1888, where it was kept in operation up to August, 1899, and then moved to Fort Stevens, where it could be more economically maintained. Daily bulletins have been exhibited for the benefit of shipping interests, and in view of the benefit to commerce its maintenance is considered a worthy object.

The amount expended on this work to June 30, 1902, was $7,402.21.

July 1, 1901, balance unexpended	$783.12
Amount appropriated by river and harbor act approved June 13, 1902	1,000.00
	1,783.12
June 30, 1902, amount expended during fiscal year	185.33
July 1, 1902, balance unexpended	1,597.79
July 1, 1902, outstanding liabilities	20.00
July 1, 1902, balance available	1,577.79

(See Appendix V V 11.)

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN WASHINGTON, IDAHO, AND MONTANA.

This district was in the charge of Maj. John Millis, Corps of Engineers. Division Engineer, Col. Jared A. Smith, Corps of Engineers, to September 23, 1901; Lieut. Col. D. P. Heap, Corps of Engineers, from September 23 to September 30, 1901, and Lieut. Col. W. H. Heuer, Corps of Engineers, since September 30, 1901.

1. *Willapa River and Harbor, Washington.*—Willapa Harbor connects with the Pacific Ocean in the extreme southwestern part of the State of Washington. Willapa River flows into the bay at its eastern extremity about 10 miles from the sea entrance to the harbor.

South Bend, the principal town on the bay and the terminus of a branch railroad running from Chehalis, is near the mouth of the river. Willapa City is a small town some 10 miles above. North River is a stream flowing into the bay from the north.

Originally shoals existed in the river below Willapa City, and there was a log jam in North River.

The original and existing project contemplates dredging 100 feet wide and to a depth of 8 feet at low water through the reef just below Willapa City, and the closing of side sloughs near South Bend by means of dikes, with the object of increasing channel depths by scour. Project was dated May 2, 1891; adopted by act of July 13, 1892.

Under acts of August 18, 1894, and March 3, 1899, removal of the log jam in North River was authorized.

The estimated cost is $36,350.

The amount expended on the existing project to close of fiscal year ending June 30, 1902, is $32,151.06, of which none was applied to maintenance.

The best channel depth at low water is now about 15 feet to South Bend and to Willapa City about 8 feet. The average tidal variation is about 8 feet.

No work was in progress during the past year.

Exports and imports.

Year.	Tons.	Value.
Fiscal year—		
1894	66,908	$639,280
1895	61,858	705,570
1896	48,960	600,600
Calendar year—		
1896	27,542	351,175
1897	37,815	313,168
1898	32,399	374,050
1899	51,150	755,682
1900	42,090	266,080
1901	39,538	229,686

The dikes require some repairs, and probably some additional dredging will be necessary.

Detailed reports on this work are given in Annual Reports of the Chief of Engineers for 1893, pages 3402–3408, and for 1895, pages 3399–3405. Maps of the locality are published with Annual Report of the Chief of Engineers for 1891, pages 3264 and 3268.

Reports of examinations and surveys are printed in the Annual Report of the Chief of Engineers for 1891, pages 3264–3268; House

Doc. No. 91, Fifty-fourth Congress, second session, and in House Doc. No. 100, Fifty-fifth Congress, second session.

By the act of June 13, 1902, the balance on hand to the credit of this improvement may be used in snagging and otherwise improving North and Nasal rivers.

July 1, 1901, balance unexpended	$4,206.94
June 30, 1902, amount expended during fiscal year	8.00
July 1, 1902, balance unexpended	4,198.94

(See Appendix W W 1.)

2. Grays Harbor and bar entrance, Washington.—Grays Harbor is a large bay in the southwestern part of the State of Washington, connecting with the Pacific Ocean. It has a total length from east to west of 17 miles, and its greatest breadth north and south is 14 miles.

A large part of the bay is occupied by tide flats, bare at low water. At low tide the area covered by water is estimated at 30.6 square miles, or less than one-third of the total area. There are two main channels crossing the bay from east to west. The north channel is the principal one, and this has been improved under a special appropriation. A short distance within the harbor entrance are large areas affording sheltered anchorages for deep-draft vessels.

The harbor entrance is between two low sandy peninsulas which are about 12,500 feet apart, measured between high-tide lines.

Through this entrance there is a channel having a maximum depth of 100 feet or more. A single broad waterway extends for more than 2 miles out to sea from the entrance, with depths gradually diminishing to 30 feet. At the outer end of this deep waterway lies a bar convex to the sea and extending each way to the sand spits on the two sides of the harbor throat.

Across the bar there was originally no good permanent channel, but there were several variable, shifting channels having depths of about 12 or 13 feet. The general average width of the bar between the inner and outer 18-foot curve is one-half mile.

The original and existing project, dated March 20, 1895, provides for the control of the tidal currents by means of a single jetty extending out to sea from the point on the south side of the harbor throat a distance of about 3½ miles, with a view to improving and maintaining the channel over the bar by scour. The jetty is to be of rubblestone, built above high-tide level. This project contemplates a depth of 24 feet at mean low water.

The estimated cost is $1,000,000. The existing project was approved by act of June 3, 1896.

The amount expended to June 30, 1902, was $835,878.90.

The act making the first appropriation for this work authorized the making of a contract or contracts for the completion of the project. In accordance with this authority, a contract for the entire work was entered into after due advertisement. This contract was approved by the Chief of Engineers February 23, 1898, and work under it commenced in March, 1898. The available depths over the bar have been materially greater throughout the year than they were before the work was started, but there have been variations in the locality of the best water. The minimum channel depth at the close of the past year was 19 feet at mean lower low water. The rise and fall of the tide varies from 8.4 feet to 12.9 feet. The best depth extended over sufficient

width of channel for all commercial needs. During the year the jetty trestle was extended 2,096 feet, making the total length 13,064 feet at the close of the year. The trestle was seriously injured during the winter, rendering extensive repairs necessary. The rock work has been extended over the full length of the trestle, but is not generally up to contemplated grade. Work was actively in progress at the close of the past fiscal year.

Exports and imports.

	Tons.	Value.
Fiscal year—		
1893	298,236	$4,431,743
1894	302,102	3,221,500
1895	159,744	848,591
1896	227,351	1,420,055
Calendar year—		
1896	110,748	629,677
1897	150,908	1,071,747
1898	168,468	1,252,089
1899	265,918	1,979,998
1900	259,692	2,077,087
1901	299,607	1,877,800

A report of the survey, giving a full description of this work, with plan, is published in the Annual Report of the Chief of Engineers for 1895, pages 3517–3528, and in Senate Ex. Doc. No. 112, Forty-seventh Congress, first session.

The sundry civil act of June 28, 1902, provides as follows:

Improving Grays Harbor, Washington: For completing improvement of harbor and bar entrance, one hundred and fifty-six thousand seven hundred and seventy-five dollars.

July 1, 1901, balance unexpended	[a]$266,140.93
Amount appropriated by sundry civil act approved June 28, 1902	156,775.00
	422,915.93
June 30, 1902, amount expended during fiscal year	258,794.83
July 1, 1902, balance unexpended	164,121.10
July 1, 1902, outstanding liabilities	15,108.12
July 1, 1902, balance available	149,012.98
July 1, 1902, amount covered by uncompleted contracts	149,012.98

(See Appendix W W 2.)

3. Grays Harbor, inner portion between Aberdeen and the entrance to said harbor, and Chehalis River, Washington.—The act of June 13, 1902, provides as follows:

Improving Grays Harbor, inner portion between Aberdeen and the entrance to said harbor, and Chehalis River, Washington: Continuing improvement, fifty thousand dollars.

Suggestions relative to the application of the above had been requested of all interested persons before the close of the year, but project for the work had not been prepared.

July 1, 1901, balance unexpended	$288.83
Amount appropriated by river and harbor act approved June 13, 1902	50,000.00
Amount transferred to this title from appropriation for improving Chehalis River, Washington	1,581.76
July 1, 1902, balance unexpended	51,870.59

(See Appendix W W 3.)

[a] Nine dollars and fifteen cents which was expended by Treasury Department was added to balance on hand in last annual money statement.

4. Chehalis River, Washington.—This river is in the southwestern part of Washington. It has a westerly course and empties into Grays Harbor Bay at its eastern extremity.

From the mouth to Montesano, 15 miles, there is about 10 feet of water at high tide. From Montesano to Elma, 16 miles, there is generally sufficient water for light-draft boats. There is practically no navigation above Elma and no regular boats go above Montesano. The river is used extensively for floating saw logs.

The original and existing project, adopted by act of August 2, 1882, contemplates the removal of snags and other obstructions which may accumulate in the portion of the river regularly used by boats. The estimated cost is indefinite. Date of project, January 26, 1882.

The amount expended to June 30, 1902, was $17,418.24, and from the nature of the work nearly all this was for maintenance.

The lower section of the river has been, as a rule, kept clear of obstructions. The maximum draft that could be carried June 30, 1902, over the shoalest part at mean low water was about 6 feet.

No work was done during the past fiscal year.

The average tidal variation is about 7 feet.

The conditions of the river require constant snagging operations to keep it clear.

General reports on Chehalis River are printed in Annual Reports of the Chief of Engineers for 1875, pages 799–800, and for 1882, pages 2687–2690.

Reports of surveys are published in Annual Report of Chief of Engineers for 1875, page 799, for 1882, page 2686, and of examination and survey printed in Senate Ex. Doc. No. 112, Forty-seventh Congress, first session.

Exports and imports.

	Tons.	Value.
Fiscal year—		
1895	4,354	$233,691
Calendar year—		
1896	2,561	246,498
1897	2,401	248,387
1898	2,730	293,610
1899	2,232	352,316
1900	4,376	132,157
1901	5,706	200,264

The act of June 13, 1902, provides as follows:

Improving Grays Harbor, inner portion between Aberdeen and the entrance to said harbor, and Chehalis River, Washington: Continuing improvement, fifty thousand dollars.

July 1, 1901, balance unexpended	$1,588.41
June 30, 1902, amount expended during fiscal year	6.65
July 1, 1902, balance unexpended, transferred to appropriation for improving Grays Harbor and Chehalis River	1,581.76

(See Appendix W W 4.)

5. Puget Sound and its tributary waters, Washington.—Most of the channels of Puget Sound proper have ample depths for purposes of navigation, but the extensive lumber and fishing industries in these waters render it very important to maintain a general supervision over the navigable channels to regulate the construction of fish traps,

log booms, and other structures incident to these important industries and to prevent obstructions which are detrimental to these as well as other navigation interests. A number of streams and rivers tributary to Puget Sound are of great value to boat navigation and for logging purposes so far as depth and width are concerned, but they are all liable to be obstructed by the débris generally found in streams flowing through a heavily wooded country.

Former projects were as follows: That of November 18, 1880, for the improvement of the Nooksak River; of June 30, 1880, for the Skagit River; of November 19, 1880, for the Stilaguamish River. These were adopted by act of August 2, 1882. By act of June 14, 1880, $2,500 was made available for removal of obstructions in the Skagit River, based on an examination made in 1875.

By act of August 4, 1892, and in subsequent acts, the appropriation has been made in its present general and comprehensive form, greatly to the advantage and economy of the work.

The existing project contemplates the removal of snags and other obstructions in any of the waters or channels where such removal may become necessary. The work is mostly attended to by a snag boat owned by the Government. The estimated cost is indefinite, as the maintenance of the channels and the necessary supervision over them requires constant work.

The amount expended to June 30, 1902, was $187,333.06.

The snag boat has been in operation during the entire year, except when laid up for about ten days for repairs, and the rivers and streams have been kept clear of obstructions. It has not been possible to give the necessary attention to the fish traps and other obstructions in the channels of the Sound proper, owing to lack of sufficient funds. A suitable boat for this service was not available at all times when needed.

The water traffic on Puget Sound and its tributary waters is very large and rapidly growing. It includes vessels of about every type and size in use throughout the world, but it is quite impracticable to give in the form of concise statistics a condensed statement of the amount and value of the commerce more or less directly benefited by work under this appropriation. Statistics have been compiled only for the tributary streams on which the snag boat has mostly worked.

Exports and imports.

Calendar year.	Tons.	Value.
1896	18,600	$358,609
1897	11,922	325,280
1898	12,676	589,406
1899	13,500	577,585
1900	35,066	1,324,926
1901	30,155	1,499,420

Reports of examinations and surveys of the rivers of Puget Sound are printed in Senate Ex. Doc. No. 39, Forty-sixth Congress, third session, House Ex. Doc. No. 38, Fifty-first Congress, second session, and House Doc. No. 204, Fifty-fifth Congress, second session.

The act of June 13, 1902, appropriated $35,000 for this work, including maintenance, and authorized the expenditure of $15,000 of this

amount for removing the log jam in the Nooksak River or cutting a new channel around the jam.

July 1, 1901, balance unexpended	$20,219.15
Amount appropriated by river and harbor act approved June 13, 1902	35,000.00
	55,219.15
June 30, 1902, amount expended during fiscal year	14,052.21
July 1, 1902, balance unexpended	41,166.94
July 1, 1902, outstanding liabilities	92.10
July 1, 1902, balance available	41,074.84

(See Appendix W W 5.)

6. Harbor at Olympia, Washington.—Olympia is situated at the extreme southern point of Puget Sound, at the head of Budd Inlet. The upper end of this inlet is shoal. Shoal water extends northward from the Fourth Street Bridge for a distance of 8,750 feet to a depth of 12 feet at mean lower low water in Budd Inlet. Nothing but shallow-draft boats could reach the wharves near Fourth Street Bridge, and these only at high tide.

The original and existing project, dated September 18, 1891, and adopted by act of July 13, 1892, contemplates dredging a channel 250 feet wide and 12 feet deep at the mean of the lower low waters from the vicinity of the Fourth Street Bridge to deep water in Budd Inlet. Near its inner end the channel is to be widened to 500 feet, so as to provide a turning basin for boats using it. The estimated cost is $147,000.

The amount expended to June 30, 1902, was $122,000, none of which was for maintenance.

The channel has been dredged to the full depth contemplated for the full width of 250 feet over a part of its length and for a width of 150 feet throughout the remainder. No work was in progress during the past year, owing to lack of funds.

Some shoaling of the channel already dredged has taken place, and it is probable that not over 6 feet could be carried at mean low water through the channel dredged at the close of the fiscal year. The average tidal variation is about 11 feet.

Exports and imports.

	Tons.	Value.
Fiscal year—		
1893	95,011	$2,087,825
1894	55,148	421,225
1895	25,125	239,400
1896	28,480	266,700
Calendar year—		
1896	36,099	191,300
1897	29,800	430,900
1898	52,335	1,208,226
1899	42,694	1,173,684
1900	35,466	848,703
1901	44,559	951,435

Description and map are published in Annual Report of the Chief of Engineers for 1900, pages 4481–4483.

Reports on examination and survey of Olympia Harbor are published in Annual Report of the Chief of Engineers for 1892, pages 2734–2741,

and on survey of Deschutes River in House Doc. No. 104, Fifty-fifth Congress, second session.

The act of June 13, 1902, provides as follows:

Improving Olympia Harbor, Washington: Completing improvement, twenty-five thousand dollars.

July 1, 1901, balance unexpended	$106.25
Amount appropriated by river and harbor act approved June 13, 1902	25,000.00
	25,106.25
June 30, 1902, amount expended during fiscal year	106.25
July 1, 1902, balance unexpended	25,000.00

(See Appendix W W 6.)

7. Tacoma Harbor, Washington.—The act of June 13, 1902, provides as follows:

Improving Tacoma Harbor, Washington, in accordance with the report submitted in House Document Numbered Seventy-six, Fifty-sixth Congress, second session, seventy-five thousand dollars: *Provided*, That a contract or contracts may be entered into by the Secretary of War for such materials and work as may be necessary for the prosecution of said project, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate one hundred thousand dollars, exclusive of the amount herein appropriated: *Provided further*, That no part of said amount shall be expended until a release from liability for damages shall be obtained, if any liability exists, arising from a contract between the State of Washington and R. B. Lehman, which said contract is set forth in said document, and the right is obtained, free of charge, to deposit material dredged from said channel upon adjacent tide lands: *Provided further*, That such work shall be so conducted as not to damage the piers or foundations of bridges crossing said waterway, or the wharves adjacent thereto.

Preliminary action to secure compliance with the law in the matter of the Lehman contract and of depositing material had been taken at the close of the past year, and views and suggestions had been invited from interested persons relative to application of the available funds.

Description of proposed work is published in Annual Report of the Chief of Engineers for 1901, pages 3593–3602.

Report on examination and survey is published in House Doc. No. 76, Fifty-sixth Congress, second session.

Amount appropriated by river and harbor act approved June 13, 1902	$75,000.00
July 1, 1902, balance unexpended	75,000.00
Amount (estimated) required for completion of existing project	100,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	100,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix W W 7.)

8. Waterway connecting Puget Sound with lakes Union and Washington, Washington.—Lakes Union and Washington are bodies of fresh water near Puget Sound in the immediate vicinity of the city of Seattle. The proposed improvement contemplates a ship canal connecting them both with the Sound. There is no navigable connection at present.

The river and harbor act of September 19, 1890, contained an item directing the appointment of a Board of three officers of the Corps of Engineers to select and survey the most feasible location and to estimate the expense of constructing a ship canal to connect the waters of lakes Union, Washington, and Samamish with Puget Sound. The sum of $10,000 was appropriated for the necessary expenses.

This Board did not consider that part of the proposed waterway connecting with Lake Samamish of sufficient importance or value to justify the cost, and the connection of Lake Samamish with Puget Sound has not been seriously considered since that date.

Subsequently a detailed survey and location of the proposed canal were made in compliance with a clause in the sundry civil act of March 2, 1895.

The western end of the canal through Salmon or Shilshole Bay, instead of through Smiths Cove, as once proposed, and a modification of the location of the lower lock, were recommended by a Board of Engineer officers and approved by the Secretary of War August 14, 1898.

At this stage the project for the work as adopted by Congress was understood to contemplate the construction of a ship canal from the waters of Puget Sound through Salmon Bay to Lake Union and thence to Lake Washington, to include dredging through the flats immediately outside of Salmon Bay to a lock in the lower end of Salmon or Shilshole Bay, the construction of this lock, dredging inside of the lock through Salmon Bay, the digging of a canal from the upper end of Salmon Bay to Lake Union, dredging to the eastern end of Lake Union, and the construction of a canal and lock between lakes Union and Washington. The canal section and the lock dimensions were to be such as will accommodate the largest merchant vessels and ships of war.

The approximate cost under this project was estimated at $6,500,000. A revision of the project has been ordered by Congress.

Amount expended to June 30, 1902, $90,772.32. Of this amount $5,000 was expended in making a survey.

A channel 50 feet wide on the bottom and 16 feet deep below low water has been cut from deep water in Puget Sound along the axis of the canal for a distance of 4,300 feet. The work was done by contract, and the total length of cut to be made under the contract is 6,000 feet.

A cut 10 feet wide on the bottom and 10 feet above the bottom of the proposed canal has been partly excavated between the head of Salmon Bay and Lake Union. The total length of cut to be made is 4,500 feet; about 2,600 feet has been completed. Surveys and observations for hydraulic data have continued.

Exports and imports.

Calendar year.	Tons.	Value.
1901	210,565	$802,950

In previous reports exports and imports of the port of Seattle have been included. The above includes only the present commerce of Ballard and Salmon Bay, Lake Union, and Lake Washington.

Description of the work, etc., are published in Annual Report of the Chief of Engineers for 1892, page 2762 et seq., and for 1896, page 3356 et seq. Estimate of approximate cost, $6,331,672, with map showing main features of canal, is published in House Doc. No. 335, Fifty-seventh Congress, first session; also herewith in Appendix W W 8.

Reports of examinations and surveys are published in House Ex. Doc. No. 40, Fifty-second Congress, first session, and Senate Doc. No. 269, Fifty-fourth Congress, first session.

The act of June 13, 1902, appropriates $160,000 for continuing the improvement, but confines the work to securing a low-water channel 10 feet in depth from Shilshole Bay through Salmon Bay to the wharves at Ballard. It also provides for a Board of Engineer officers to reexamine the whole question of a ship canal connecting with Lake Washington by various routes, including proposals from a private company to construct such a canal.

July 1, 1901, balance unexpended	$162,977.66
Amount appropriated by river and harbor act approved June 13, 1902	160,000.00
	322,977.66
June 30, 1902, amount expended during fiscal year	78,749.98
July 1, 1902, balance unexpended	244,227.68
July 1, 1902, outstanding liabilities	3,608.78
July 1, 1902, balance available	240,618.90
July 1, 1902, amount covered by uncompleted contracts	58,952.87

(See Appendix W W 8.)

9. Everett Harbor, Washington.—At this harbor the southern part of the water front has ample depth and is accessible for vessels of the deepest draft. The northern portion is at present inaccessible on account of the delta formation or tide flats off the mouth of the Snohomish River.

Under date of November 4, 1893, the Acting Secretary of War granted to the Everett Land Company authority to construct certain works designed to produce a fresh-water basin at Everett that would be available for all commercial shipping, but no work was ever done in carrying out the project.

The first appropriation for the improvement of Everett Harbor was in the act of August 18, 1894—

> For dredging Everett Harbor, including mouth of Snohomish River, and Snohomish River from mouth to Lowell, in the State of Washington, the sum of $10,000.

It was decided that no dike or bulkhead construction could be done under this appropriation, and that dredging alone would not be of value, so the funds were not applied. Subsequently the dike construction was authorized by resolution of Congress dated February 1, 1895, and the project under which the original and subsequent appropriations have been applied may be stated as follows:

First, to excavate a harbor basin in the shallows and tide lands adjoining deep water near the river's mouth; second, to dredge a channel from this through the tide flats and the Old River mouth to deep fresh water in the Snohomish River, this channel being designed to bring fresh water to the harbor basin and to afford facilities for navigation about the peninsula and into the deep water of the river bounding the peninsula on the east, and third, to protect and maintain this harbor and channel across the tide flats by a bulkhead interposed between them and the open waters of the Sound, the bulkhead to act as a retaining wall for the material dredged from the harbor. The date of approval of this plan was February 14, 1895.

The estimated cost of the improvement is $422,000, the total expenditure authorized by the act of March 3, 1899.

The amount expended on the project to June 30, 1902, was $294,748.23.

A dike for the purpose of retaining the dredged material has been built from the lower end of Smiths Island along the established bulkhead line for a distance of 19,336 feet. At the southern end of this work an outside bulkhead 200 feet from the other has been built for a distance of 2,600 feet. The major part of the excavating in the harbor basin has been done. The channel leading north from this basin was partly dredged for a distance of 5,148 feet, and the channel in Old River has been dredged from the upper end for a distance of 11,600 feet downstream. The dredging was carried to the depths contemplated by the project, 26 feet below mean low water in the harbor basin and 6 feet below mean low water in the Old River channel. The average tidal variation is about 11½ feet. Some shoaling has taken place, and the work is not yet far enough advanced to produce practical results.

One shingle mill, one sash and door factory, and one pile-preserving plant were added to the industries during the past year.

Exports and imports.

Year.	Tons.	Value.
Fiscal year—		
1895	79,919	$1,845,282
1896	144,541	2,724,789
Calendar year—		
1896	210,547	5,384,831
1897	74,960	2,974,526
1898	55,460	2,545,054
1899	42,713	1,477,120
1900	55,094	1,820,561
1901	71,881	2,712,260

Description of the work and maps are published in Annual Report of the Chief of Engineers for 1895, pages 3430–3435, and for 1901, pages 3587–3589.

Reports on examinations, surveys, etc., are published in House Ex. Doc. No. 47, Fifty-second Congress, second session, and Senate Ex. Docs. Nos. 53, 139, and 139, part 2, Fifty-third Congress, second session.

Joint resolution of Congress approved April 23, 1902, is as follows:

JOINT RESOLUTION providing for a modification in the adopted project for the improvement of Everett Harbor, Washington.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That in carrying on the work of improvement of Everett Harbor, Washington, authorized in the river and harbor act of March third, eighteen hundred and ninety-nine, the Secretary of War may, in his discretion, abandon the dredging and improvement of Old River, and any balance heretofore appropriated or authorized for the present approved project may be used for the widening or deepening of the harbor basin and channel through the tide flats, and the Secretary of War may take such steps as may seem to him desirable to protect and conserve the work as performed.

Approved, April 23, 1902.

The sundry civil act of June 28, 1902, provides as follows:

Improving harbor at Everett, Washington: For continuing improvement, one hundred and seventeen thousand dollars.

July 1, 1901, balance unexpended	$156,799.30
Amount appropriated by sundry civil act approved June 28, 1902	117,000.00
	273,799.30
June 30, 1902, amount expended during fiscal year	146,547.53
July 1, 1902, balance unexpended	127,251.77
July 1, 1902, outstanding liabilities	10,461.50
July 1, 1902, balance available	116,790.27
July 1, 1902, amount covered by uncompleted contracts	116,790.27

(See Appendix W W 9.)

10. Swinomish Slough, Washington.—This slough affords an inland sheltered passage for small vessels from Puget Sound proper northward to Bellingham Bay and the Gulf of Georgia, and it is the only means of communication to the town of Laconner located on the slough. The total distance by way of the slough from good water in Skagit Bay to navagable depths in Padilla Bay is about 11 miles.

At the northern end the slough opens out into the flats forming the southern portion of Padilla Bay, in the midst of diked land and marshes. At the southern end the best channel to deep water in Saratoga Passage crosses extensive flats, which are almost bare at low water.

The original project, dated December 14, 1891, and adopted by act of July 13, 1892, contemplates dredging a channel 4 feet deep and 100 feet wide from deep water in Saratoga Passage across Skagit Flats, through the shoals of the slough proper and across the flats of Padilla Bay to deep water, and to build dikes in Skagit and Padilla bays to direct the tidal currents through the dredged channels.

The estimated cost is $122,000.

The amount expended to June 30, 1902, was $90,448.59.

The dike work completed to date is all between Laconner and deep water in Saratoga Passage, as follows: Single row of piles to catch drift between Goat and Ika islands, 4,000 feet; wattled pile dike, 3,000 feet; pile, brush, and stone dike, 7,200 feet.

A considerable portion of this has been rebuilt and repaired. A channel of the depth and width contemplated by the project has been dredged from deep water at the southern end northward to about the middle point of the slough. Some local shoaling has occurred, and not over 2 feet can be carried through to Laconner from Saratoga Passage at low water. Through traffic has not yet been benefited, as the improvement has not been extended to Padilla Bay.

The average tidal variation is about 8 feet.

A small amount of repair work to the dikes was done during the year.

The work yet to be done, according to the original estimate, includes 6,000 linear feet of dike in Padilla Bay, 6,000 linear feet of dike in the slough proper, 90,000 cubic yards of dredging in Padilla Bay, and 30,000 cubic yards of dredging in the slough proper. Additional work in channels already dredged and repairs to the dikes will also be required.

Exports and imports.

	Tons.	Value.
Fiscal year—		
1893	55,700	$1,510,000
1894	64,050	1,637,000
1895	114,917	1,713,020
1896	131,370	1,709,700
Calendar year—		
1896	65,375	1,347,664
1897	64,497	1,190,000
1898	19,625	882,345
1899	76,636	2,028,454
1900	74,516	1,611,460
1901	136,747	2,991,330

A report of a survey of Swinomish Slough, upon which the plan of improvement is based, is printed with a general map in House Ex. Doc. No. 31, Fifty-second Congress, first session, and reprinted without map in the Annual Report of the Chief of Engineers for 1892, pages 2753–2962.

A map showing parts of the improvement is published in the Annual Report of the Chief of Engineers for 1900, opposite page 4488.

Report on examination and survey is printed in House Ex. Doc. No. 31, Fifty-second Congress, first session.

The act of June 13, 1902, provides as follows:

Improving Swinomish Slough, Washington: Continuing improvement, thirty thousand dollars.

July 1, 1901, balance unexpended	$4,573.57
Amount appropriated by river and harbor act approved June 13, 1902	30,000.00
	34,573.57
June 30, 1902, amount expended during fiscal year	22.16
July 1, 1902, balance unexpended	34,551.41
July 1, 1902, outstanding liabilities	329.00
July 1, 1902, balance available	34,222.41

(See Appendix W W 10.)

11. Improving New Whatcom Harbor, Washington.—The act of June 13, 1902, provides as follows:

Improving New Whatcom Harbor, Washington, in accordance with the report submitted in House Document Numbered Eighty, Fifty-fifth Congress, first session, twenty-five thousand dollars: *Provided*, That no part of this appropriation shall be expended until provision shall have been made, satisfactory to the Secretary of War, to prevent the deposit in the channel to be improved of sawdust and refuse from the mills.

Preliminary action to secure compliance with the provisions of this act in the matter of depositing saw-mill refuse had been taken at the close of the past fiscal year, but a detailed project had not been adopted.

Description of proposed work is published in Annual Report of the Chief of Engineers for 1897, pages 3478–3481.

Reports on examination and survey are published in House Ex. Doc. No. 228, Fifty-third Congress, third session, and House Doc. No. 80, Fifty-fifth Congress, first session.

Amount appropriated by river and harbor act approved June 13, 1902	$25,000.00
July 1, 1902, balance unexpended	25,000.00

(See Appendix W W 11.)

12. Okanogan and Pend Oreille rivers, Washington.—(*a*) *Okanogan River.*—This river rises in Canadian territory, flows in a southerly direction, and empties into the Columbia. The lower portion, for a distance of 87 miles, lies in the northeastern part of Washington. The river has a general width of 300 to 400 feet through its entire length in the United States, and the lower portion has sufficient depth for light-draft navigation throughout the year, but it is obstructed in places by shoals and rocks which prevent any navigation except during the summer high water. The upper stretches are also obstructed by snags.

The original and existing project, dated December 18, 1897, adopted by act of March 3, 1899, contemplates rock removal, the construction of wing dams, and snagging.

The estimated cost is $30,000. The amount expended to June 30, 1902, was $15,000.

Work of removing rocks and bowlders, wing-dam construction, and placing posts to assist vessels in hauling over rapids has been done at various points over about 40 miles of the lower portion of the river. It is estimated that the available depth has been increased about 1 foot.

No work was done during the last fiscal year owing to lack of funds.

Exports and imports.

Year.	Tons.	Value.
1899	1,733	$151,415
1900	(a)	(a)
1901	963	

a Not obtainable.

The increased depth has rendered the river navigable for a longer period of the year than formerly was the case.

Descriptions of the river and the plan of improvement are given in the Annual Report of the Chief of Engineers for 1888, page 3121.

Report on examination of Okanogan River is published in Annual Report of the Chief of Engineers for 1895, page 3475; report of survey is printed in House Doc. No. 211, Fifty-fifth Congress, second session.

(*b*) *Pend Oreille River.*—This river forms the outlet of Pend Oreille Lake, in the northern part of Idaho.

The obstructions to navigation consist of rocks and shoals in Box Canyon, and in the section between this canyon and Albany Falls.

The original and existing project, dated December 28, 1897, and adopted by act of March 3, 1899, contemplates the improvement of Box Canyon by the removal of submerged rocks, the blowing off of projecting rocky points, and the removal of submerged rocks between Box Canyon and Albany Falls. The estimated cost is $30,000.

The amount expended to June 30, 1902, was $8,784.50, none of which was directly for maintenance.

The work done has resulted in partly clearing away the obstructions in Box Canyon, but this produced little or no benefit to navigation. On account of the character of the improvement, no benefit is to be expected until the improvement is completed.

No work was done during the fiscal year ending June 30, 1902, owing to lack of funds.

Exports and imports.

Year.	Tons.	Value.
1899	2,617	$129,677
1900	1,921	97,125
1901	13,917	134,280

Descriptions of the river and the plan of improvement are given in the Annual Report of the Chief of Engineers for 1898, page 3124.

Report of survey of the river is printed in House Doc. No. 235, Fifty-fifth Congress, second session.

The act of June 13, 1902, provides as follows:

Improving the Okanogan and Pend Oreille Rivers, Washington, twenty-two thousand five hundred dollars, of which amount so much as may be necessary shall be used for completing the improvement of the Okanogan, and the remainder for continuing improvement and for maintenance of the improvement of the Pend Oreille.

July 1, 1901, balance unexpended	$1,490.50
Amount appropriated by river and harbor act approved June 13, 1902	22,500.00
	23,990.50
June 30, 1902, amount expended during fiscal year	275.00
July 1, 1902, balance unexpended	23,715.50
July 1, 1902, outstanding liabilities	25.00
July 1, 1902, balance available	23,690.50

(See Appendixes W W 12–14.)

13. Kootenai River, Idaho, between Bonners Ferry and the international boundary line.—The Kootenai River is a tributary of the Columbia. Its middle portion is in the United States, in the extreme northwestern part of Montana and northern part of Idaho. Both the upper and the lower portion, including its junction with the Columbia, lie in Canadian territory.

The part that has been improved, between Bonners Ferry and the international boundary line, is about 30 miles in length. It was originally navigable, with difficulty, by small, light-draft steamers.

The original and existing project, dated January 1, 1895, and adopted by act of June 3, 1896, contemplates removing the snags in the river and the leaning trees on the banks which are liable to fall in and become obstructions. The estimated cost is $5,000.

The amount expended to June 30, 1902, was $4,254.54.

The entire stretch of river included within the limits of the project has been practically cleared of snags.

No work was done during the past fiscal year.

A report of an examination of the Kootenai River between Jennings, Mont., and the international boundary line, a length of about 80 miles, is printed in Annual Report of the Chief of Engineers for 1901, page 3603 et seq.

A description of the river between Bonners Ferry and the international boundary line is published in the Annual Report of the Chief of Engineers for 1893, pages 3456–3458.

Report of examination of the river is printed in House Ex. Doc. No. 93, Fifty-second Congress, second session; and of survey of the river in House Ex. Doc. No. 233, Fifty-third Congress, third session.

Exports and imports.

Calendar year.	Tons.	Value.
1896	1,600	$42,815
1897	2,212	49,025
1898		40,699
1899		30,508
1900		14,586

Two million feet B. M. of saw logs was floated down the river during the year. No other statistics were obtainable.

The act of June 13, 1902, made no provision for work on this river.

July 1, 1901, balance unexpended	$745.46
July 1, 1902, balance unexpended	745.46

(See Appendix W W 15.)

14. Flathead River, Montana.—This river lies in the northwestern part of Montana. It belongs to the Columbia River system. The portion of the river included within the limits for which this appropriation was made is about 27 miles in length. This portion has a minimum depth of about 10 feet, but it is obstructed by snags.

The original and existing project, dated August 5, 1895, and adopted by act of June 3, 1896, is for the removal of snags in the river between Demarsville and Flathead Lake.

The estimated cost was indefinite. The amount expended to June 30, 1902, was $9,810.77.

The entire stretch of river embraced in the project has been snagged and a large jam of driftwood was removed from the channel.

There appears to be ample depth for a vessel drawing 24 inches of water, which is sufficient for present commerce.

No work was done during the past year.

A description of this work is given in the Annual Report of the Chief of Engineers for 1895, pages 3480–3484.

Exports and imports.

	Tons.		Tons.
1898	78	1900	456
1899	368	1901	341

Two thousand two hundred and twenty-one passengers were carried and 60,000,000 feet B. M. of saw logs was floated down the river during the year.

The act of June 13, 1902, made no appropriation for work on this river.

July 1, 1901, balance unexpended	$189.23
July 1, 1902, balance unexpended	189.23

(See Appendix W W 16.)

SUPERVISION OF THE HARBOR OF NEW YORK.

The supervisor of the harbor during the past year was Lieut. Commander H. M. Hodges, United States Navy, to May 5, 1902, and Commander Edward F. Qualtrough, United States Navy, since that date.

The office of supervisor of the harbor of New York was created by act of Congress approved June 29, 1888, entitled "An Act to prevent obstructive and injurious deposits within the harbor and adjacent waters of New York City, by dumping or otherwise, and to punish and prevent such offenses." This act has been amended by section 3 of the act of August 18, 1894, entitled "An Act Making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes," by which amendment the functions and powers of the officer have been greatly enlarged. Additional duties are also conferred on the supervisor by section 2 of the last-named act.

Under the provisions of section 5 of the act of June 29, 1888, a line officer of the Navy is designated to discharge the duties created by the act under the direction of the Secretary of War. On May 23, 1889, the Secretary of War directed that all communications in connection with these duties should be addressed to him through this office, and on February 1, 1890, he further directed that the powers conferred upon him by the act should be exercised through the Chief of Engineers.

The report of Commander Qualtrough for the fiscal year ending June 30, 1902, is submitted as Appendix X X.

Estimates for the fiscal year ending June 30, 1904.—The estimates of funds required for this service for the fiscal year ending June 30, 1904, are given in the above-mentioned report, as follows:

For pay of inspectors, deputy inspectors, office force, and expenses of office..	$10,260
For pay of crews and maintenance of five steam tugs and three launches....	60,000
For generally overhauling and repairing steam tug *Lamont*.....	5,000
For the purchase or construction of one steam tug	45,000
Total	120,260

CALIFORNIA DÉBRIS COMMISSION.

The act of Congress approved March 1, 1893, provided for the establishment of the California Débris Commission, to consist of three officers of the Corps of Engineers, appointed by the President, with the concurrence of the Senate, whose functions relate to hydraulic mining in the territory drained by the Sacramento and San Joaquin river systems in California.

Regulation of hydraulic mining.—The Commission is empowered to devise means and issue permits for resuming and carrying on hydraulic mining operations under conditions that will not injure other interests in the State.

The Commissioners during the past fiscal year were Col. Jared A. Smith, to September 22, 1901; Lieut. Col. D. P. Heap, from September 22, 1901; Lieut. Col. W. H. Heuer; Capt. Herbert Deakyne, to August 23, 1901, and First Lieut. R. P. Johnston, from August 23, 1901.

Up to June 30, 1902, the Commission received 565 applications to mine by the hydraulic process and granted 445 permits.

Estimate for the fiscal year ending June 30, 1904.—The Commission submits an estimate of $15,000 as the amount required during the fiscal year ending June 30, 1904, for payment of the necessary expenses connected with the work of regulating hydraulic mining as required by the act of Congress approved March 1, 1893.

Improvement and protection of rivers.—The act of Congress approved March 1, 1893, creating the California Débris Commission, also empowered and required the Commission to adopt plans for improving the navigation of the rivers in the systems above mentioned, and to project and construct works for impounding detritus and preventing the deterioration of the rivers from the deposit of hydraulic mining and other débris. Under this requirement of the act the Commission prepared a project and plans for impounding débris in the Yuba River, at an estimated cost of $800,000 (project printed in House Doc. No. 431, Fifty-sixth Congress, first session; also printed in the Annual Report of the Chief of Engineers for 1900, Part VIII, p. 5030).

The estimated cost of this project has now been appropriated, $400,000 by Congress and $400,000 by the legislature of California, the appropriations by Congress having been made with provisions that one-half the expense should be paid by the State of California.

The amount expended by the United States on the work of the project above referred to, up to the close of the fiscal year ending June 30, 1902, is $5,337.25, all of which was for land needed for the projected works on Yuba River. Title to most of the land required has now been acquired by the United States. One-half the cost of all the land purchased has been paid by the United States and the other half by the State of California. Specifications were prepared recently for the construction of a portion of the dam known in the above-mentioned project as Barrier No. 1. It is contemplated that a contract for the work included in the specifications will be entered into at an early date.

The following money statement includes only funds appropriated by Congress, and does not include funds appropriated by the legislature of California:

July 1, 1901, balance unexpended	$250,000.00
Amount appropriated by river and harbor act approved June 13, 1902	150,000.00
	400,000.00
June 30, 1902, amount expended during fiscal year	5,337.25
July 1, 1902, balance unexpended	394,662.75

(See Appendix Y Y.)

MISSISSIPPI RIVER COMMISSION.

The Mississippi River Commission, constituted by act of Congress of June 28, 1879, is in charge of the improvement of the Mississippi River from Head of Passes to the mouth of the Ohio River, including the rectification of Red and Atchafalaya rivers at their junction with the Mississippi, the building of levees, and the improvement of the several harbors for which specific appropriations have been made, with the exception of the harbor of Vicksburg and the mouth of Yazoo River. It is also charged with the survey of the Mississippi River from Head of Passes to its head waters, and with gauging the river and its tributaries.

The Commissioners during the past fiscal year were: Col. Amos Stickney, Corps of Engineers, president; Lieut. Col. Thomas H. Handbury, Corps of Engineers, to January 22, 1902; Lieut. Col. H. M. Adams, Corps of Engineers; Maj. Thos. L. Casey, Corps of Engineers, since January 22, 1902; B. M. Harrod, Robert S. Taylor, Henry L. Marindin, assistant, United States Coast and Geodetic Survey, and J. A. Ockerson.

The report of the Commission upon the operations under its charge during the fiscal year ending June 30, 1902, was submitted to the Secretary of War August 23, 1902, and is printed in a supplement to this report.

Estimates for the fiscal year ending June 30, 1904.—The following estimates of funds required for carrying on the works under its charge for the year ending June 30, 1904, are submitted by the Commission:

For continuing the improvement of the Mississippi River from Head of Passes to the mouth of the Ohio River, including salaries and clerical, office, traveling, and miscellaneous expenses of the Mississippi River Commission	$2,000,000
Protection of banks at or near Caruthersville, Mo	30,000
Improving harbor at Memphis, Tenn. (including Hopefield Bend and Wolf River)	50,000
Improving harbor at Greenville, Miss	25,000
Delta Point, La. (preservation of existing works)	25,000
Improving harbor at Natchez, Miss., and Vidalia, La	100,000
Rectification of Red and Atchafalaya rivers, Louisiana	30,000
Improving harbor at New Orleans, La	300,000
Total	2,560,000

MISSOURI RIVER COMMISSION.

The Missouri River Commission, constituted by act of Congress of July 5, 1884, is in charge of the improvement and surveys of the Missouri River below Sioux City, Iowa.

The Commissioners during the past fiscal year were: Col. Amos Stickney, Corps of Engineers, president; Lieut. Col. Thomas H. Handbury, Corps of Engineers, to January 22, 1902; Maj. W. L. Marshall, Corps of Engineers; Maj. Thos. L. Casey, Corps of Engineers, since January 22, 1902; Garland C. Broadhead, and C. L. Chaffee.

The river and harbor act of August 18, 1894, in making appropriations for improvement of Gasconade and Osage rivers, Missouri, provided that the funds should be expended by the Missouri River Commission, and the work of improving these streams has since been carried on under its direction.

The report of the Commission upon operations under its charge during the fiscal year ending June 30, 1902, was submitted to the Secretary of War August 23, 1902, and is printed in a supplement to this report.

ESTABLISHMENT OF HARBOR LINES.

Under authority given to the Secretary of War in section 11 of the river and harbor act approved March 3, 1899, harbor lines have been established during the past fiscal year at the following localities, details of which will be found in the reports of the local officers:

Mystic River at Somerville, Boston, Mass.; Newport Harbor, Rhode Island; Hudson River at Adams Island, Troy, N. Y.; Hudson River at New Baltimore, N. Y.; Bowery Bay, East River, at Steinway, New York, N. Y.; East River in front of the Cob Dock, United States navy-yard, Brooklyn, N. Y.; Buttermilk Channel, New York Harbor, at Atlantic Basin, Brooklyn, N. Y.; New York Harbor, New York, at Shooters Island; New York Harbor, New York, at Ellis Island; Delaware River in front of the United States navy-yard at League Island, Pa.; Pasquotank River at Elizabeth City, N. C.; Lavaca Bay at Port Lavaca, Tex.; Monongahela River from Homestead Bridge to McKees-

port, Pittsburg Harbor, Pennsylvania; North Branch of Chicago River at Chicago, Ill.; St. Lawrence River at Alexandria Bay, N. Y.; Commencement Bay at Tacoma, Wash.; Missouri River in front of Kansas City, Mo., and Kansas City, Kans.

CHICAGO DRAINAGE CANAL.

On May 8, 1899, the Secretary of War granted a conditional permit to the Sanitary District of Chicago to connect its artificial channel with the Chicago River and cause the waters of said river to flow into the canal. The rate of flow has been modified from time to time as required in the interest of navigation.

RULES AND REGULATIONS GOVERNING THE FLOATING OF LOOSE LOGS, THE NAVIGATION OF CANALS, ETC., AND THE OPENING OF DRAWBRIDGES.

Rules and regulations for the navigation of streams on which the floating of loose timber and logs and sack rafts of timber and logs is the principal method of navigation.—Under the provisions of act of Congress approved May 9, 1900, "An Act Authorizing the Secretary of War to make regulations governing the running of loose logs, steamboats, and rafts on certain rivers and streams," the Secretary of War has prescribed rules and regulations for the navigation of *East Pearl River, Mississippi.*

Rules and regulations for the navigation of canals and similar works of navigation.—Section 4 of the river and harbor act of August 18, 1894, delegates to the Secretary of War the duty of prescribing such rules and regulations for the use, administration, and navigation of any or all canals and similar works of navigation that now are or that hereafter may be owned, operated, or maintained by the United States, as in his judgment the public necessity may require. Such rules and regulations have been established for the following-named works: Portage Lake Ship Canal, across Keweenaw Point, Michigan; Louisville and Portland Canal, Kentucky; Kentucky River, Kentucky, locks and dams; Green and Barren rivers, Kentucky, locks and dams; Little Kanawha River, West Virginia, locks and dams; Kanawha River, West Virginia, locks and dams; Lagrange and Kampsville locks, Illinois River, Illinois; Morgans Cut and Morgans Canal, Texas; Muscle Shoals Canal, Tennessee River; Des Moines Rapids Canal, Mississippi River; dry dock at Des Moines Rapids Canal, Mississippi River; Galena River improvement, Illinois; Davis Island dam, Ohio River, Muskingum River, Ohio, lock, dams, and canal; Sturgeon Bay and Lake Michigan Ship Canal, Wisconsin; Fox River, Wisconsin, locks and canals; St. Marys Falls Canal, Michigan; St. Clair Flats Canal, Michigan; Monongahela River, Pennsylvania and West Virginia, Locks 8 and 9; Sandusky Harbor, Ohio; St. Marys River, Michigan, Middle Neebish Channel; Rough River, Kentucky, locks and dam; Wabash River, Indiana and Illinois, lock and dam at Grand Rapids; Yamhill River, Oregon, lock and dam at Lafayette; Black Warrior River, Alabama, Locks 1–4; Cascades Canal, Columbia River, Oregon; Illinois and Mississippi Canal around lower rapids of Rock River at Milan, Ill.; Duluth and Superior Harbor, Minnesota and Wisconsin; Big Sandy River, West Virginia and Kentucky, lock and dam at Louisa, Ky.

Rules and regulations governing the opening of drawbridges.—Section 5 of the river and harbor act of August 18, 1894, provides that it shall be the duty of all persons owning, operating, and tending the drawbridges now built, or which may hereafter be built, across the navigable rivers and other waters of the United States, to open, or cause to be opened, the draws of such bridges under such rules and regulations as in the opinion of the Secretary of War the public interests require for the passage of vessels and other water craft. Such rules and regulations have been established by the Secretary of War for certain drawbridges over the following-named waterways: Fore River, Maine; Matanzas River, Florida; Illinois River, Illinois; Sakonnet River, Rhode Island; Tanners Creek, Virginia; Christiana River, Delaware; Brandywine River, Delaware; Western Branch of Elizabeth River, Virginia; Newtown Creek, New York; Norwalk River, Connecticut; Kent Island Narrows, Maryland; Youngs Bay, Oregon; Wattuski River, Oregon; Lewis and Clark River, Oregon; Skipanon River, Oregon; John Day River, Oregon; Blind Slough, Oregon; Clatskanie River, Oregon; Oak Creek, Maryland; Tennessee River; entrance to Back Cove, Portland Harbor, Maine; Galena (Fever) River, Illinois; Severn River, Maryland; Smith Creek, Virginia; Mississippi River between St. Paul, Minn., and mouth of Missouri River; Ohio River; Mystic River, Massachusetts; Passaic River and Newark Bay, New Jersey; Quinnipiac River, Connecticut; Mill River, Connecticut; arm of New Haven Harbor, Connecticut; Harlem River, New York; Schuylkill River, Pennsylvania; Newark Bay, New Jersey, and its navigable tributaries (Passaic and Hackensack rivers); Paradise Creek, Virginia.

BRIDGING NAVIGABLE WATERS OF THE UNITED STATES.

Plans and maps of locations of the following bridges, proposed to be erected under the authority of special acts of Congress, have been examined with a view to protection of the interests of navigation, and have been approved by the Secretary of War, as provided by the acts; and the local engineer officers have been furnished with copies of the instruments of approval and drawings showing plans and locations, and charged with the supervision of the construction of the bridges so far as necessary to see that they are built in accordance with the approved plans:

1. Bridge of the Louisville and Nashville Railroad Company over Choctawhatchee River at Geneva, Ala.—Plans and map of location of a bridge proposed to be built at this place under authority of act of Congress approved February 23, 1901, were approved by the Secretary of War July 12, 1901.

2. Bridge of the Pittsburg and Mansfield Railroad Company over Monongahela River near Ferry street, Pittsburg, Pa.—Plans for the construction of this bridge were approved by the Secretary of War May 20, 1896 (see Annual Report of the Chief of Engineers for 1896, p. 423). Modified plans involving a slight change in the line of the bridge and in the location and size of piers were approved by the Secretary of War July 17, 1901.

3. Bridge of the Texas and Pacific Railway Company over Red River at Turnbulls Island, Louisiana.—Plans and map of location of a bridge proposed to be built at this locality under authority of act of

Congress approved March 3, 1901, were approved by the Secretary of War September 4, 1901.

4. Bridge of the Baltimore and Potomac Railroad Company over Potomac River (Long Bridge) at Washington, D. C.—Plans for the construction of a bridge to replace the existing structure at this place under authority of act of Congress approved February 12, 1901, were approved by the Secretary of War October 25, 1901.

5. Bridge of the Charleroi and Monessen Bridge Company over Monongahela River from North Charleroi to a point in Rostraver Township, Pennsylvania.—Plans and map of location of a bridge at this place proposed to be built under authority of act of Congress approved March 3, 1901, were approved by the Secretary of War December 18, 1901.

6. Bridge of the New Orleans and Northwestern Railway Company over Bœuf River near Rayville, La.—Plans for the reconstruction of the existing bridge at this place were approved by the Secretary of War January 7, 1902.

7. Bridge of the Southern Illinois and Missouri Bridge Company over Mississippi River between Thebes, Ill., and Grays Point, Missouri.—Plans and map of location of a bridge proposed to be built at this place under authority of act of Congress approved January 26, 1901, were approved by the Secretary of War January 16, 1902, and modified plans providing for increased length of clear span were approved March 17, 1902.

8. Bridge of the Cross Creek Railroad Company over Ohio River near Mingo Junction.—Plans and map of location of a bridge proposed to be built at this place received consideration by a Board of Engineers, as required by act of Congress of December 17, 1872, as amended by act of February 14, 1883, and the plans were approved by the Secretary of War February 7, 1902.

9. Bridge of the Southern Missouri and Arkansas Railroad Company over Current River, Arkansas.—The construction of the bridge at this place was authorized by act of Congress approved February 11, 1902. Plans and map of location were approved by the Secretary of War February 28, 1902.

10. Bridge of the Mississippi River, Hamburg and Western Railway Company over Bayou Bartholomew near Portland, Ark.—Plans for construction of a bridge at this place were approved by the Secretary of War March 17, 1898 (see Annual Report of the Chief of Engineers for 1898, p. 531). A bridge was built, but not in accordance with approved plans, and the time for completion fixed by law expired, but was extended by act of Congress of February 4, 1902. Plans for rebuilding the bridge were approved by the Secretary of War March 15, 1902.

11. Bridge of Houghton County, Mich., over Portage Lake, between Houghton and Hancock.—Plans for rebuilding this bridge were approved by the Secretary of War January 7, 1901 (see Annual Report of the Chief of Engineers for 1901, p. 664). Plans for reconstructing the Houghton approach by the Copper Range Railway Company were approved by the Secretary of War March 20, 1902.

12. Bridge of the St. Clair Terminal Railroad Company over Monongahela River at Clairton Station, Pa.—Plans and map of location of a bridge proposed to be built at this place, under authority of an act of Congress approved March 10, 1902, were approved by the Secretary of War March 26, 1902.

13. Bridge of the Chicago, Burlington and Quincy Railroad Company over the Mississippi River at Quincy, Ill.—Plans for rebuilding the drawspan of the bridge, under authority of act of Congress of April 24, 1902, were approved by the Secretary of War May 3, 1902.

Under the provisions of section 9 of the river and harbor act approved March 3, 1899, bridges may be built over navigable waters entirely within the limits of any State, under the authority of legislative enactment of such State, when the plans and locations of the structures are approved by the Secretary of War. Plans and maps of locations of the following bridges proposed to be erected under these provisions have been examined with a view to protection of the interests of navigation, and have been approved by the Secretary of War; and the local engineer officers have been furnished with copies of the drawings and instruments of approval, and charged with the supervision of construction of the bridges so far as necessary to see that they are built in accordance with the approved plans:

1. Bridge of the Gulf, Colorado and Santa Fe Railway Company over Trinity River in Liberty County, Tex.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War July 6, 1901.

2. Bridge of the New Bedford and Onset Street Railway Company over Wareham River at the Narrows, Wareham, Mass.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War July 10, 1901.

3. Bridge of the Atlantic Coast Line over Trent River near Pollocksville, N. C.—Plans for the reconstruction of the bridge at this place were approved by the Secretary of War August 2, 1898 (see Annual Report of the Chief of Engineers for 1898, p. 536). Plans for protection of the center pier of this bridge were approved by the Secretary of War July 11, 1901.

4. Bridge of Middlesex County, N. J., over Woodbridge Creek between Perth Amboy and Woodbridge.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War July 12, 1901.

5. Bridge of the St. Louis, Kansas City and Colorado Railroad Company over Gasconade River, Missouri.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War July 13, 1901.

6. Bridge of the Middleboro, Wareham and Buzzards Bay Street Railway Company over Buttermilk Bay between Bourne and Wareham, Mass.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War July 18, 1901.

7. Bridge of the Middleboro, Wareham and Buzzards Bay Street Railway Company over Swifts River at Onset, Mass.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War July 18, 1901.

8. Bridge of Beaufort County, N. C., over Blounts Creek.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War July 19, 1901.

9. Bridge of the St. Louis Valley Railway over Kaskaskia River in Randolph County, Ill.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War August 5, 1901.

10. Bridge of the Macon, Dublin and Savannah Railroad Company over Oconee River at Dublin, Ga.—Plans for a bridge proposed to be built at this place were approved by the Secretary of War January 27, 1891 (see Annual Report of the Chief of Engineers for 1891, p. 430). Plans in substitution for those heretofore approved were approved by the Secretary of War August 6, 1901.

11. Bridge of the Suwanee and San Pedro Railroad Company over Suwanee River, Florida.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War August 9, 1901.

12. Bridge of the Southern Pacific Company on line of the Iberia and Vermilion Railroad over Bayou Vermilion at Abbeyville, La.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War August 9, 1901.

13. Bridge of the Seattle-Tacoma Railway Company over canal waterway at Seattle, Wash.—Plans and map of location for a bridge proposed to be built at this place were approved by the Secretary of War August 12, 1901.

14. Bridges of the Seattle-Tacoma Interurban Railway over White River near Black River Junction, Wash., White River near Kent, Wash., Duwamish River in King County, Wash., and Puyallup River in Pierce County, Wash.—Plans and maps of locations for bridges proposed to be built at these places were approved by the Secretary of War August 13, 1901.

15. Bridge of the Pennsylvania Company over Monongahela River at Pittsburg, Pa.—Plans for the reconstruction of the existing bridge at this place were approved by the Secretary of War August 19, 1901.

16. Bridge of Laporte County, Ind., over Trail Creek (Michigan City inner harbor), Ind.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War August 19, 1901. Modified plans providing for a change of location and of the superstructure were approved by the Secretary of War November 11, 1901.

17. Bridge of the Washington and Plymouth Railroad Company over Runyans Creek, North Carolina.—Plans and map of location of a bridge proposed to be built at this locality were approved by the Secretary of War August 22, 1901.

18. Bridge of Norfolk County, Mass., over Weymouth Fore River between Quincy and Weymouth.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War August 22, 1901. Modified plans providing for certain changes in the method of constructing the substructure, a slight increase in the width of the bridge and length of drawspan, and a decrease of proposed fill, were approved by the Secretary of War November 16, 1901.

19. Bridge of Vermilion Parish, La., over Vermilion Bayou at D. O. Broussard's crossing.—Plans and map of location of a bridge proposed to be built at this locality were approved by the Secretary of War August 29, 1901.

20. Bridges of the Bergen Turnpike Company over Overpeck Creek at Ridgefield, and Hackensack River at Little Ferry, N. J.—Plans and maps of locations of bridges proposed to be built at these places were approved by the Secretary of War August 29, 1901.

21. Bridges of the Seattle Electric Company over Duwamish River

near Seattle, and over Lake Union at Seattle, Wash.—Plans and maps of locations of bridges proposed to be built at these places were approved by the Secretary of War September 6, 1901.

22. Bridge of the Mobile, Jackson and Kansas City Railroad Company over Pascagoula River at Merrill, Miss.—Plans for the construction of this bridge were approved by the Secretary of War September 10, 1895 (see Annual Report of the Chief of Engineers for 1896, p. 424). Modified plans involving slight reduction in width of draw opening were approved by the Secretary of War September 9, 1901.

23. Bridge of the St. Louis, Kansas City and Colorado Railroad Company over Osage River, Missouri.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War September 21, 1901.

24. Bridge of King County, Wash., over Duwamish River.—Plans and map of location for a bridge proposed to be built at this place were approved by the Secretary of War September 23, 1901.

25. Bridge of the Washington and Oregon Railway Company over Lewis River, Washington.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War September 28, 1901.

26. Bridge of the Pere Marquette Railroad Company over Kalamazoo River at Allegan, Mich.—Plans and map of location for a bridge proposed to be built at this place were approved by the Secretary of War October 1, 1901.

27. Bridge of the city of Milwaukee, Wis., over Milwaukee River at Grand avenue.—Plans for the construction of this bridge were approved by the Secretary of War June 5, 1900 (see Annual Report of the Chief of Engineers for 1900, p. 701). Plans for a temporary bridge for use during the construction of the permanent bridge were approved by the Secretary of War October 9, 1901.

28. Bridge of the Chicago and Northwestern Railway Company over Wisconsin River at Merrimac, Wis.—Plans for the reconstruction of the existing bridge at this place were approved by the Secretary of War October 9, 1901.

29. Bridge of the Chicago and Northwestern Railway Company over the Illinois and Mississippi Canal, in Bureau County, Ill.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War October 9, 1901.

30. Bridge of Warren County, Miss., over Black River, near Fishers Ferry, Miss.—Plans and map of location for a bridge proposed to be built at this place were approved by the Secretary of War October 10, 1901.

31. Bridge of the Seattle and Montana Railroad Company over Snohomish River at Everett, Wash.—Plans for rebuilding the existing structure at this place were approved by the Secretary of War October 10, 1901.

32. Bridge of the Yazoo and Mississippi Valley Railroad Company over Coldwater River, in Quitman County, Miss.—Plans and map of location for a bridge proposed to be built at this place were approved by the Secretary of War October 14, 1901.

33. Bridge of the city of Dartmouth, Bristol County, Mass., over Apponagansett River at South Dartmouth.—Plans and map of location for a bridge proposed to be built at this place were approved by the Secretary of War October 30, 1901.

34. Bridge of the Chicago, Burlington and Quincy Railroad Company over the Missouri River at Plattsmouth, Nebr.—Plans for the reconstruction of the existing bridge at this place were approved by the Secretary of War November 5, 1901.

35. Bridge of the Boston, Revere Beach and Lynn Railroad Company over Crystal Cove at Winthrop, Mass.—Plans for reconstruction of the existing bridge at this place were approved by the Secretary of War November 8, 1901.

36. Bridge of Vermilion Parish, La., over Bayou Vermilion at Perry.—Plans and map of location for a bridge proposed to be built at this place were approved by the Secretary of War December 3, 1901.

37. Bridge of the Southern Pacific Railroad Company over Sacramento River at Knights Landing, Cal.—Plans for rebuilding the bridge at this place were approved by the Secretary of War December 3, 1901.

38. Bridge of the Southern Pacific Railroad Company over Napa River at Napa Junction, Cal.—Plans for the reconstruction of the existing bridge at this place were approved by the Secretary of War December 3, 1901.

39. Bridge of the city of Cleveland, Ohio (Middle Seneca Street Bridge), over Cuyahoga River.—Plans for rebuilding the existing bridge at this place were approved by the Secretary of War December 4, 1901.

40. Bridge of Essex County, Mass., over Merrimac River, between Newburyport and Salisbury.—Plans for rebuilding the existing structure at this place were approved by the Secretary of War December 20, 1901.

41. Bridge of the city of Philadelphia, Pa., over Schuylkill River at Passyunk avenue.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War December 21, 1901.

42. Bridge of the city of Durand, Wis., over Chippewa River.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War January 7, 1902.

43. Bridge of Jackson County, Fla., over Chipola River at Peacock's log landing.—Plans and map of location for a bridge proposed to be built at this place were approved by the Secretary of War January 8, 1902.

44. Bridge of the Bridgeton and Millville Traction Company over Oranoken Creek at Beaver Dam, N. J.—Plans and map of location of the bridge proposed to be built at this place were approved by the Secretary of War January 17, 1902.

45. Bridge of the Yazoo and Mississippi Valley Railroad Company over Yazoo River near Yazoo City, Miss.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War January 29, 1902.

46. Bridge of the West Shore Railroad Company and the New York Central and Hudson River Railroad Company over Rondout Creek near Kingston Station, N. Y.—Plans for the reconstruction of the existing bridge at this place were approved by the Secretary of War January 30, 1902.

47. Bridge of the Morris and Essex Railroad Company over Passaic River at Newark, N. J.—Plans for rebuilding the existing structure

at this place were approved by the Secretary of War February 5, 1902.

48. Bridge of Clay County, W. Va., over Elk River near the mouth of Big Otter Creek.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War February 5, 1902.

49. Bridge of the West Shore Railroad Company and the New York Central and Hudson River Railroad Company over Overpeck Creek at Little Ferry, N. J.—Plans for the reconstruction of the existing bridge at this place were approved by the Secretary of War February 7, 1902.

50. Bridge of the New York, New Haven and Hartford Railroad Company over Pawtucket (Seekonk) River at India Point, Providence, R. I.—Plans for the reconstruction of this bridge were approved by the Secretary of War February 14, 1902.

51. Bridge of the Elizabeth Park and Land Company over Broad Creek, Virginia.—Plans and map of location for a bridge proposed to be built at this place were approved by the Secretary of War February 14, 1902.

52. Bridge of the Norfolk, Portsmouth and Newport News Railway Company over Western Branch of Elizabeth River at Norfolk, Va.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War February 25, 1902.

53. Bridge of the Michigan Central Railroad Company over Trail Creek at Michigan City, Ind.—Plans for rebuilding the existing structure at this place were approved by the Secretary of War March 4, 1902.

54. Bridge of the city of Boston, Mass. (Broadway Bridge), over Fort Point Channel.—Plans for rebuilding the existing structure at this place were approved by the Secretary of War March 7, 1902.

55. Bridge of the Charleston, S. C., Mining and Manufacturing Company over Ashley River, South Carolina.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War March 7, 1902.

56. Bridge of the Norfolk and Southern Railroad Company over Pasquotank River, North Carolina.—Plans for rebuilding the existing structure at this place were approved by the Secretary of War March 7, 1902.

57. Bridge of Polk County, Minn., over Red Lake River at Fisher.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War March 10, 1902.

58. Bridge of the city of New York over Dutch Kills Creek on the line of Borden avenue, New York, N. Y.—Plans for the reconstruction of the existing bridge at this place were approved by the Secretary of War March 12, 1902.

59. Bridge of the Brandywine Railway Company over Brandywine Creek at Wilmington, Del.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War March 17, 1902.

60. Bridge of Camden County, N. J., over Cooper Creek at Baird avenue, Camden.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War March 26, 1902.

61. Bridge of the Eureka and Fresh Water Railway Company over Jarnigan Slough, California.—Plans and map of location of a bridge

proposed to be built at this place were approved by the Secretary of War March 26, 1902.

62. Bridge of the Chicago, Milwaukee and St. Paul Railway Company over Fox River at Green Bay, Wis.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War March 26, 1902.

63. Bridge of the Cleveland, Cincinnati, Chicago and St. Louis Railway Company over White River at Indianapolis, Ind.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War April 8, 1902.

64. Bridge of King County, Wash., over Snoqualmie River near its junction with Tolt River.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War April 8, 1902.

65. Bridge of the New York Central and Hudson River Railroad Company over Peekskill Bay near Peekskill, N. Y.—Plans for reconstruction of the center pier of the draw span of this bridge were approved by the Secretary of War April 11, 1902.

66. Bridge of the Dundalk, Sparrows Point and North Point Railway Company over Bear Creek near Sparrows Point, Md.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War April 14, 1902.

67. Bridge of Polk County, Minn., over Red Lake River at East Grand Forks.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War April 18, 1902.

68. Bridge of the city of Boston, Mass., over Fort Point Channel at Cove street.—Plans for rebuilding the existing bridge at this place were approved by the Secretary of War July 10, 1900 (see Annual Report of the Chief of Engineers for 1901, page 661). Modified plans were approved by the Secretary of War April 18, 1902.

69. Bridge of Greene County, Miss., over Chickasahay River near Leakesville.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War April 25, 1902.

70. Bridge of Greene County, Miss., over Leaf River near Atkinsons Creek or Cochrans Ferry.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War April 25, 1902.

71. Bridge of the Maumee Railway Bridge Company over Maumee River near Toledo, Ohio.—Plans for construction of a bridge at this place were approved by the Secretary of War August 17, 1900 (see Annual Report of the Chief of Engineers for 1901, p. 667). Modified plans were approved by the Secretary of War April 25, 1902.

72. Bridge of the city of Seattle, Wash., over the Lake Washington Ship Canal right of way at Fremont, Wash.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War April 29, 1902.

73. Bridge of W. C. Baker over Hook Creek, Long Island, N. Y.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War May 10, 1902.

74. Bridge of the city of Milwaukee, Wis., over the North Menominee Canal at Muskego avenue.—Plans for rebuilding the existing bridge at this place were approved by the Secretary of War May 12, 1902.

75. Bridge of the city of Seattle, Wash., over the eastern arm of Lake Union at Hester avenue.—Plans for rebuilding the existing bridge at this place were approved by the Secretary of War May 29, 1902.

76. Bridge of the State of Massachusetts over Mystic River between Somerville and Medford, Mass.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War May 29, 1902.

77. Bridge of the Seattle Electric Company over the Puget Sound and Lake Washington Canal right of way at Fremont avenue, Seattle, Wash.—Plans for reconstructing the existing bridge at this place were approved by the Secretary of War May 29, 1902.

78. Bridge of Middlesex County, N. J., over Raritan River between the cities of Perth Amboy and South Amboy.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War May 31, 1902.

79. Bridge of the Kentucky Lumber and Veneer Company over North Fork of Kentucky River below Jackson, Ky.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War June 5, 1902.

80. Bridge of the city of Saginaw, Mich., over Saginaw River at Genessee avenue.—Plans for rebuilding the existing structure at this place were approved by the Secretary of War June 9, 1902.

81. Bridge of the Central Railroad Company of New Jersey over Newark Bay, between Elizabethport and Bayonne, N. J.—Plans for reconstructing the existing bridge at this place were approved by the Secretary of War June 12, 1902.

82. Bridge of the Chicago, Milwaukee and St. Paul Railway Company over Wisconsin River at Kilbourn City, Wis.—Plans for rebuilding the existing bridge at this place were approved by the Secretary of War June 14, 1902.

83. Bridge of the Sanitary District of Chicago over South Branch of Chicago River at Loomis street, Chicago, Ill.—Plans for a bridge to replace the existing structure at this place were approved by the Secretary of War June 23, 1902.

84. Bridge of the Pennsylvania Railroad Company over Monongahela River at Port Perry, Pa.—Plans for rebuilding the existing structure at this place were approved by the Secretary of War June 25, 1902.

85. Bridge of the town of Essex, Mass., over Essex River.—Plans for reconstruction of the existing bridge at this place were approved by the Secretary of War June 26, 1902.

86. Bridge of the Solvay Process Company over Rouge River at Delray, Mich.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War June 28, 1902.

Under the provisions of section 18 of the river and harbor act approved March 3, 1899, relating to bridges obstructing navigation, plans for alteration of the following bridges, so as to render navigation through or under them reasonably free, easy, and unobstructed, have been examined and approved by the Secretary of War, and the local engineer officers have been furnished with copies of the plans and instruments of approval and charged with supervision of the work of alteration so far as necessary to see that the approved plans are complied with:

1. Bridge of the Pere Marquette Railroad Company over Grand River, near foot of Wealthy avenue, Grand Rapids, Mich.—The reconstruction of this bridge in the interest of navigation being deemed necessary, and plans for such reconstruction having been voluntarily presented by the company, they were approved by the Secretary of War August 31, 1901.

2. Bridge of the Brooklyn Heights Railroad Company (West End Bridge) over Coney Island Creek, New York.—Notice of the Secretary of War dated August 28, 1901, requiring alteration of this bridge having been served on the company, plans for reconstructing the bridge in conformity with requirements of the Department were submitted December 12, 1901; approved by the Secretary of War December 20, 1901.

3. Bridge of the Cleveland, Cincinnati, Chicago and St. Louis Railway Company over Pawpaw River near Benton Harbor, Mich.—Notice of the Secretary of War dated December 5, 1901, requiring alteration of this bridge having been served on the company, plans for reconstructing the bridge in conformity with the requirements of the Department were submitted March 3, 1902; approved by the Secretary of War March 21, 1902.

BRIDGES OBSTRUCTING NAVIGATION.

Under the requirements of section 18 of the river and harbor act approved March 3, 1899, the Secretary of War notified the persons, corporations, or associations owning or controlling certain bridges obstructing navigation, after giving them a reasonable opportunity to be heard, to so alter said bridges as to render navigation through or under them reasonably free, easy, and unobstructed, specifying in the notice the alterations required to be made and prescribing a reasonable time in which to make them, as follows:

1. Bridge of Currituck County, N. C., over Tulls Creek.—Notice dated August 12, 1901, served on the board of commissioners August 20, 1902. Specified alterations to be completed within five months from date of service of notice.

2. Bridge of the Brooklyn Heights Railroad Company (West End Bridge) over Coney Island Creek, New York.—Notice dated August 28, 1901, served on the company September 13, 1901. Specified alterations to be completed on or before April 1, 1903.

3. Bridge of the Seattle and San Francisco Railroad and Navigation Company over the waterway between Elliott Bay and mouth of Duwamish River at Seattle, Wash.—Notice dated October 9, 1901, served on the company October 21, 1901. Specified alterations to be completed on or before January 1, 1903.

4. Bridge of the New York Central and Hudson River Railroad Company over Chaumont River near Chaumont, N. Y.—Notice dated October 15, 1901, served on the company October 25, 1901. Specified alterations to be completed within nine months from date of service of notice. Subsequently the time for completing alteration of this bridge was extended to April 1, 1903.

5. Bridge of the Cleveland, Cincinnati, Chicago and St. Louis Railway Company over Pawpaw River near Benton Harbor, Mich.—Notice requiring alteration of this bridge having been served on the company (see Annual Report of the Chief of Engineers for 1901, page

668), the matter was reconsidered and new notice dated December 5, 1901, served on the company December 16, 1901. Specified alterations to be completed on or before April 1, 1902.

6. Bridges (2) of the Pere Marquette Railroad Company over Pawpaw River near Benton Harbor, Mich.—Notices requiring alteration of these bridges having been served on the company (see Annual Report of the Chief of Engineers for 1901, page 668), the matter was reconsidered and new notices dated December 5, 1901, were served on the company December 14, 1901. Specified alterations to be completed on or before April 1, 1902.

7. Bridges (2) of the city of Benton Harbor and township of Benton, Mich., over Pawpaw River near Benton Harbor, Mich.—Notices requiring alteration of these bridges having been served on the proper officials (see Annual Report of the Chief of Engineers for 1901, page 668), the matter was reconsidered and new notices dated December 5, 1901, were served on the mayor of the city and the highway commissioners of the township December 14 and 16, 1901, respectively. Specified alterations to be completed on or before April 1, 1902.

8. Bridge of Cumberland County, N. J., over Dividing Creek at the town of Dividing Creek.—Notice dated February 13, 1902, served on the board of chosen freeholders February 19, 1902. Specified alterations to be completed within ten months from date of service of notice.

9. Bridge of the Charleston and Western Carolina Railway Company over Savannah River below Augusta, Ga.—Notice dated June 2, 1902, served on the company June 18, 1902. Specified alterations to be completed on or before September 1, 1902, for alteration designated as "1" and on or before January 1, 1903, for alteration designated as "2."

MISCELLANEOUS.

[Public works not provided for in acts making appropriations for the construction, repair, and preservation of works on rivers and harbors.]

BRIDGES AT WASHINGTON, D. C.

Operations under this head were in the charge of Lieut. Col. Chas. J. Allen, Corps of Engineers.

1. Repair of the Aqueduct Bridge across Potomac River.—The work pertaining to reconstruction of pier No. 4 of this bridge was all completed by July 15, 1901. The work was done under an appropriation of $65,000 made by Congress for that purpose June 8, 1896.

For a fuller account of the work reference is made to the Annual Report of the Chief of Engineers for 1901, pages 669–671.

Under the provisions of the deficiency act of March 3, 1901, temporary repairs were made during the year to other piers of the bridge.

July 1, 1901, balance unexpended	$26,356.67
June 30, 1902, amount expended during fiscal year	10,878.71
July 1, 1902, balance unexpended	15,477.96

(See Appendix B B B 1.)

2. Memorial Bridge.—The sundry civil act approved June 4, 1897, provided for a survey, examination, etc., as follows:

Memorial bridge across Potomac River: To enable the Chief of Engineers of the Army to make the necessary surveys, soundings, and borings, and for securing designs and estimates for a memorial bridge from the most convenient point of the Naval

Observatory grounds, or adjacent thereto, across the Potomac River to the most convenient point of the Arlington estate property, two thousand five hundred dollars.

The report of this survey, with maps, was published in House Doc. No. 388, Fifty-fifth Congress, second session. (See Annual Report of the Chief of Engineers for 1898, p. 3573.)

By act approved March 3, 1899, Congress made the following appropriation:

Memorial bridge across Potomac River: To enable the Chief of Engineers of the Army to continue the examination of the subject and to make or secure designs, calculations, and estimates for a memorial bridge from the most convenient point of the Naval Observatory grounds, or adjacent thereto, across the Potomac River to the most convenient point of the Arlington estate property, the sum of five thousand dollars.

Competitive designs with estimates for the bridge were obtained from four of the most distinguished American bridge engineers, each of whom associated with himself at least one architect of established reputation and ability. The designs were all very complete, the estimates accurately and carefully made, and the competition in every way gratifying.

The report of the Board of officers of the Corps of Engineers and of architects appointed by order of the Secretary of War to consider and report upon the relative merits of these designs was submitted March 28, 1900, and it is to be regretted that time admitted of but a very few of the numerous and valuable drawings obtained being reproduced in it.

The Board recommended that design No. 2 of those submitted by Mr. W. H. Burr be adopted, with minor modifications taken mainly from his design No. 1, the cost of which modifications the detail in which his plans had been worked up rendered susceptible of easily and accurately estimating. The estimated cost of the design as recommended is $4,860,000.

This report of the Board was transmitted to Congress and published in House Doc. No. 578, Fifty-sixth Congress, first session. (Also printed in the Annual Report of the Chief of Engineers for 1900, p. 5126.)

There are no operations to report for the year ending June 30, 1902, there having been no appropriation for constructing the bridge.

July 1, 1901, balance unexpended	$220.70
June 30, 1902, amount expended during fiscal year	.75
July 1, 1902, balance unexpended	219.95

(See Appendix B B B 2.)

3. Highway bridge over Potomac River at Washington, D. C.— Section 12 of an act of Congress approved February 12, 1901, provides for the construction of a highway bridge to replace the existing Long Bridge.

By authority of the Secretary of War, a Board of Engineers was constituted to select a site and to formulate plans, specifications, and estimates for the bridge. The Board submitted report, dated October 25, 1901, which was transmitted to Congress for its information. It is printed in House Doc. No. 138, Fifty-seventh Congress, first session, and is herewith as Appendix B B B 3.

MAINTENANCE AND REPAIR OF THE WASHINGTON AQUEDUCT; INCREASING THE WATER SUPPLY OF WASHINGTON, D. C., AND WASHINGTON AQUEDUCT, DISTRICT OF COLUMBIA, FILTRATION PLANT.

These works were in the charge of Lieut. Col. Alexander M. Miller, Corps of Engineers, having under his immediate orders Lieut. George M. Hoffman, Corps of Engineers, until April 30, 1902, and after that date Lieut. William P. Wooten, Corps of Engineers.

1. Washington Aqueduct.—Valves and mains in the vaults at the gatehouses were cleaned and painted. The grounds, drainage channels, and slope walls at the reservoirs were repaired and kept in good order. From August 8, 1901, to October 14, 1901, the Georgetown distributing reservoir was out of service in order that connection might be made between the reservoir and the west shaft gatehouse, the city being supplied through the by-conduit.

During the past year the extreme fluctuation of the water level in the distributing reservoir was 3.65 feet.

The Conduit road has been repaired, the gutters, ditches, culverts, and drains have been cleaned, and grass and weeds cut along the embankments. About 20 cubic yards of deposit were removed from the mouth of the conduit. About 200 feet of the by-conduit at the Dalecarlia Reservoir were grouted with Portland cement to stop small leakage. Six thousand three hundred and ten cubic yards of stone were crushed and spread on the Conduit road, and the dirt road between the club house and Great Falls was repaired.

Small repairs were made to the floors of the bridges, which are now in fair condition.

New stations at Rock Creek shaft, Champlain avenue shaft, and the Washington City Reservoir were added to the private telephone line.

Measurements of the daily and hourly consumption and waste of water were made during nine months, and gave a daily average of 55,921,367 gallons. The consumption and waste, measured on June 24, 1902, were found to be 57,474,790 gallons per diem. This is the largest June measurement ever taken, and, estimating the population of the District of Columbia as 279,878, gives a daily per capita consumption and waste of 205 gallons.

Careful and trustworthy investigations made in various cities in the United States show clearly that a daily per capita consumption of 100 gallons is ample for all domestic, business, and public purposes, and that any considerable increase above this amount must be attributed to waste. This extravagant use of water has become a serious menace to the supply of water by the Washington Aqueduct with its present capacity—76,000,000 gallons—and at the rate of increase the ultimate limit would be reached in about twelve years.

The present consumption and waste have also an important bearing on the subject of filtration. A filtration plant has been authorized by Congress and is now being constructed. It is probable that the cost of filtration will be about $6 per million gallons, or, at the present rate of consumption, about $300 per day or $110,000 annually. This is a large charge, and can be reduced only by a reduction in consumption.

By a compromise of certain suits, long pending against the Government in the Court of Claims, the United States has acquired title to the land on which the aqueduct dam is built, is released from liability

on account of past diversion of water at Great Falls, and is confirmed in the right to use water up to the limit of 153,000,000 U. S. gallons per diem.

In the opinion of the local engineer officer in charge of the aqueduct, the existing conditions suggest two remedies—either the reduction of the consumption to a reasonable rate, 100 gallons per capita per diem, by the use of meters, or the increase of the present supply to keep up with the present demand by the building of a second conduit from the Great Falls of the Potomac. The necessary surveys of practicable routes for this conduit should be taken in hand at once, and an estimate for this work is submitted by the officer in charge.

Estimates are submitted for building a combined storehouse and stable at Great Falls, for preliminary surveys for an additional conduit from Great Falls, and for operation, maintenance, and repair of the Washington Aqueduct and its accessories, all of which have my approval and of which full explanations will be found in the report of the officer in charge.

The estimates for the fiscal year ending June 30, 1904, are as follows:

For building combined storehouse and stable at Great Falls	$3,000.00
For preliminary surveys for additional conduit from Great Falls	8,000.00
For operation, maintenance, and repair of the aqueduct and its accessories, including the Conduit road, the Washington City Reservoir, and the Washington Aqueduct Tunnel	33,000.00
Total	44,000.00
Amount appropriated by act approved March 1, 1901	22,000.00
June 30, 1902, amount expended during fiscal year	22,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904	33,000.00

(See Appendix C C C 1.)

2. Increasing the water supply of Washington, D. C.—This work is being prosecuted under acts making appropriations to provide for the expenses of the government of the District of Columbia. The act approved June 30, 1898, authorized and directed the Secretary of War to resume work on the Washington Aqueduct Tunnel and its accessories and the Howard University Reservoir in accordance with the plans of the board of experts as set forth in its report, dated January 17, 1896, and the work has been done in accordance with those plans.

During the year the following work has been accomplished:

West shaft gatehouse.—The brickwork of the superstructure was covered with Portland cement plaster blocked off to represent stonework. The connection between the gatehouse and the reservoir was constructed. The inside walls and wood and iron work were painted. A fence was built around the gatehouse and the grounds were cleaned up.

Foundry Branch shaft.—The earth filling over the concrete filling was placed in the shaft, completing the work of closing the shaft.

Rock Creek shaft.—The lining of the shaft and the 48-inch blow-off, the brickwork of the pump pit, and the walls and roof of the power house over the pump pit and shaft were completed. On December 3, 1901, when the tunnel was completely filled, the pressure (about 60 pounds) developed several breaks in the suction pipe of the pumping plant which was being placed by the contractor. This necessitated the pumping out of the tunnel and the insertion of a valve in the suction pipe between the tunnel and the breaks, and delayed placing the tunnel in operation until January 8, 1902.

Champlain avenue shaft.—The brick lining of the shaft, the valve chamber and the connection with the city supply, the foundation for the compressor for the pumping plant, the foundation and walls of the power house, and the roof of the power house were completed.

Pipe lines.—The filling in over the pipe lines across the reservoir, the pipe lines through the dam for the blow-off, the drains, and the city connections were completed in December, 1901.

The reservoir.—The bottom of the reservoir was thoroughly cleaned before filling and the paving of the slopes was completed. The work on the Congressional spring house was completed. A 48-inch valve was placed on one of the blank ends of the "Y" at the south end of the 75-inch main and a valve chamber built. The power house at east shaft was completed. The east shaft gatehouse has been completed with the exception of some cleaning, painting, plastering, and placing of stairway, window sash, and drains. The grounds around the gatehouse were partially graded, and the puddle core along the front of the gatehouse, connecting with the puddle core of the dam, was completed.

Pumping plants.—The air lift plants at east shaft and Champlain avenue shaft were tested and accepted by the United States. The completion of the centrifugal pumping plant at Rock Creek has been delayed from time to time by breaks developed during tests.

Filling tunnel and reservoir.—In October, 1901, the water was turned into the Washington City Reservoir from the city mains, but from lack of pressure only rose to an elevation of 125 feet. On November 25, 1901, the water was turned into the tunnel from the Georgetown distributing reservoir, and the Washington City Reservoir was allowed to fill from flow from the tunnel. The water rose to 145.60 feet above datum when, on December 3, 1901, a break occurred in the suction pipe of the pumping plant at Rock Creek. Both reservoirs were then shut off from the tunnel and the break repaired. On January 6 and 7, 1902, the water was again turned into the tunnel and on January 8, 1902, all connections between the tunnel, the reservoirs, and the city mains were opened and the new works placed in service. This addition increased the head throughout the entire gravity system by from 12 to 20 feet.

Completion of work.—The work remaining to be done includes fencing, improving grounds, gatekeepers', watchmen's, and other houses, and constructing the outer slope of dam at reservoir. An appropriation of $67,240 for this work was contained in the District of Columbia appropriation act for the fiscal year 1903, and no further estimates are submitted. The pay of the additional watchmen and gatekeepers required is included in the Washington Aqueduct estimates.

July 1, 1901, balance unexpended	$285,025.89
June 30, 1902, amount expended during fiscal year	265,002.41
July 1, 1902, balance unexpended	20,023.48
July 1, 1902, outstanding liabilities	155.12
July 1, 1902, balance available	19,868.36
July 1, 1902, amount covered by uncompleted contracts	19,868.36
Amount (estimated) required for completion of existing project	[a] 67,240.00

(See Appendix C C C 2.)

[a] Appropriated in act of July 1, 1902.

3. Washington Aqueduct, District of Columbia, filtration plant.—By act approved June 6, 1900, $200,000 was appropriated "For establishing those portions of a filtration plant which are essential to the operation of either system of filtration adopted, including necessary land, grading, masonry, and appurtenances," and by act approved March 1, 1901, $500,000 was appropriated "toward establishing a slow sand filtration plant."

With these appropriations the necessary land has been acquired at a cost of $619,928.55, drawings of various details have been made, buildings and derricks erected, excavation made for the clear-water reservoir and 274 linear feet of the east wall built, drawings made for the superstructure of the gatehouse and some work done on the gatehouse, four lines of 48-inch cast-iron pipe laid between the gatehouse and the clear-water reservoir, the excavation for the foundation of the intake and the concrete substructure completed and four 48-inch sluice gates set; the topographical survey of the land bought has been finished and maps of the ground made; the portion of the reservoir between the gatehouse and the clear-water reservoir has been filled and the slopes paved.

Mr. Allen Hazen was employed as consulting engineer on the preparation of plans for a filtration plant during the latter part of the fiscal year.

It is estimated that the filtration plant can be constructed in two years. The appropriation in the act of July 1, 1902, providing for the expenses of the District of Columbia for the fiscal year 1903 was $600,000, with authority to enter into contracts for the completion of the plant at a cost of $2,768,405 less the above amounts of $600,000 and $700,000 already appropriated. This leaves $1,468,405 to be appropriated, and if the work is to be completed in the fiscal year 1904 this amount will be needed during that year, as estimated by the officer in charge.

July 1, 1901, balance unexpended	$33,730.40
June 30, 1902, amount expended during fiscal year	33,668.15
July 1, 1902, balance unexpended	62.25
July 1, 1902, outstanding liabilities	62.25
Amount (estimated) required for completion of existing project	2,068,405.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the amount appropriated by act of July 1, 1902	1,468,405.00

(See Appendix C C C 3.)

IMPROVEMENT AND CARE OF PUBLIC BUILDINGS AND GROUNDS AND CARE AND MAINTENANCE OF THE WASHINGTON MONUMENT, IN THE DISTRICT OF COLUMBIA.

Officer in charge, Col. Theo. A. Bingham, United States Army.

The Executive Mansion has received the usual care and such repairs and improvements as the funds available would admit. The exterior of the building has been repainted. Two rooms for servants have been constructed in the attic. Miscellaneous painting has been done in the interior of the house, and some carpets, matting, furniture, and furnishings purchased. Work has been commenced for remodeling the mansion and for building a separate office building for the President.

Repairs were made to the conservatory, the greenhouses, and the stable.

At the Washington Monument the usual care required for maintenance has been extended. The work of painting the iron work in the interior, running new electric-light wires, and replacing the 70-volt lamps with lamps of 110 volts has been completed.

Inspections have been made from time to time of the various buildings occupied as offices by the War Department, except the State, War, and Navy Departments building in connection with their care, repair, and safety.

At the propagating gardens necessary repairs were made to the greenhouse structures, an additional plant house constructed, one of the greenhouses remodeled and rebuilt, a portion of the roadway between the gardens and the Bureau of Engraving and Printing graded and improved, the new roadways planned for the development of the gardens marked out, about 784,000 plants propagated, and the work of filling in low portions of the addition to the grounds continued, some 22,000 cubic yards of earth having been received and spread. The work of constructing a brick building for shops at the propagating gardens has been completed.

The care required to maintain them in good condition has been extended to the improved parks and park places. Twenty of the small unimproved reservations, containing 2.08 acres, have been brought to the first stage of improvement. The asphalt pavements in the parks have been extended by the construction of 1,401 square yards of foot walk and 830 square yards of asphalt roadway, and 1,663 square yards of asphalt foot walk repaired and resurfaced. Five hundred and sixty-one feet of iron drain pipe and 1,959 feet of water pipe have been laid, 148 feet of stone curb set, 314 linear feet of cobblestone gutter, 1,966 linear feet of cinder foot walk and 1,963 linear feet of board foot walk constructed, the iron post-and-chain and the iron post-and-bar fences inclosing 3 of the larger parks, 1 circle, and 45 of the small triangular reservations painted.

A statue of Rochambeau and pedestal for same have been erected in Lafayette Park, and the statue was unveiled May 24, 1902. The work of setting a stone coping around the site of the Sherman statue has been completed, and work in connection with the construction of that statue continued.

Attention has been given to the telegraph line connecting the Capitol with the Departments and the Government Printing Office. The desirability of replacing the present overhead system of wires with underground conduits and cables is submitted for the action of Congress and printed in House Doc. No. 135, Fifty-sixth Congress, second session.

The damage done by a storm in February, 1897, and by high tides and wind in October, 1898, to the iron pile wharf at Bridge Creek Landing, Virginia, near Wakefield, the birthplace of Washington, has not yet been repaired, there being no funds available for the work.

Attention is invited to the detailed report of the officer in charge and to his estimates and recommendations for the fiscal year ending June 30, 1904.

The estimates are as follows:

For the improvement and care of public buildings and grounds in charge of the Chief of Engineers		$141,630.00
For compensation of persons employed on public buildings and grounds.		71,880.00
For repair of existing telegraph lines connecting Capitol and Departments		1,500.00
For contingent and incidental expenses of public buildings and grounds.		700.00
For care of Washington Monument and maintenance of elevator:		
Salaries of employees	$8,520.00	
Fuel, lights, contingencies, etc	3,000.00	
		11,520.00
Total		227,230.00

(See Appendix D D D.)

NORTHERN AND NORTHWESTERN LAKES—CORRECTING AND ISSUING CHARTS—SURVEYS—WATER LEVELS.

As early as 1816 local surveys of the Great Lakes for special purposes were made by engineer officers, but the "Lake Survey" as a systematic work was commenced in 1841. It was diligently prosecuted thereafter until 1882, when for a time extended field operations were suspended. The correction, printing, sale, and issue of charts continued without cessation, however, the additions and corrections being largely based upon local surveys and reports by engineer officers in charge of river and harbor improvements on the lakes.

Systematic field work was resumed in 1889, and has since been prosecuted with increased vigor. In 1898 operations were extended to include the cognate work of observing and investigating the levels of the Great Lakes and their connecting waters, with a view to their regulation in the interest of commerce. The survey proper has from the beginning been carried on under the War Department, being at first conducted by the Chief of Topographical Engineers and by the Chief of Engineers after the consolidation of the Topographical Engineers with the Corps of Engineers.

The first regular appropriation for the survey was made in 1841, and annual appropriations followed, with the single exception of 1847. The appropriations to date for all purposes of the survey during the sixty-one years of its existence have aggregated $3,361,879, of which $2,411.81 has reverted to the Treasury.

The following extract from Professional Papers of the Corps of Engineers, United States Army, No. 24, describes the conditions governing the navigation of the Great Lakes in 1841:

1. The lake survey was begun in 1841 under an appropriation of $15,000 made in May of that year. At this time the country bordering on the lower lakes was already pretty well settled, and works for the improvement or formation of harbors had been commenced at most of the important points on Lakes Erie and Ontario. The upper lake region was but thinly settled, and there were no good harbors on Lake Huron and but one (the harbor of Chicago) on Lake Michigan. Settlers were, however, pouring in rapidly, and there was even then a large and constantly increasing commerce between the lake ports, especially from Buffalo to Detroit and Chicago. Communication with Lake Superior could only be had by portage around the Sault Ste. Marie, but the great mineral wealth of the Lake Superior country was attracting attention, and a survey for a ship canal had been made in 1840 by officers of the Topographical Engineers. The lake commerce was carried on under many difficulties, which caused much loss of life and property each year.

There were no charts of the lakes except the Admiralty charts compiled from the surveys of Capt. H. W. Bayfield, of the royal navy (English), and these were not in

general use by the masters of American vessels. These charts were the results of rapid reconnaissances, and although they showed the coast lines with an accuracy which is remarkable, considering the rough methods of surveying employed, they were of little value as hydrographical charts of the American coast, because they showed the depths of water in comparatively few places, and but a small number of the many reefs and shoals which are found along the lake shores.

There were few light-houses and beacons to indicate the positions of dangers to navigation, and, in the absence of charts, pilots were obliged to rely upon their own knowledge, which was frequently only acquired by the vessel's grounding on a shoal or striking a hidden rock.

The navigation of the lakes is attended with peculiar dangers, because, while violent gales are frequent and the storms rival those of the ocean itself, a vessel is never more than a few hours' run from the shore, and can not, as is generally the case at sea, drift before the wind until the storm is over, but in a long-continued gale must be thrown upon the shore, unless a port or harbor of refuge can be entered. In 1841 a vessel leaving Chicago found no harbor or shelter in storms until the Manitou or Beaver Islands were reached, and after passing the Straits of Mackinac it was again exposed without refuge on Lake Huron, except in the vicinity of Presque Isle, until the head of St. Clair River was reached. In sailing from Chicago to Buffalo the greatest difficulties were encountered in the vicinity of the Straits of Mackinac and in the west end of Lake Erie, on account of the many islands, shoals, and reefs found in those localities, and at the mouth of the St. Clair River, at which no improvements had been made in 1841, and where the channels were not only circuitous and narrow, but so shoal that vessels in low-water seasons frequently were compelled to have their cargoes taken over the bars in lighters.

It was therefore with the double object of furnishing reliable charts to lake vessels and of determining from the surveys the works of improvement which were necessary to the prosperity of the lake commerce that Congress in 1841 directed a survey of the lakes, and that annual appropriations, with the single exception of the year 1847, have since been made for carrying on the survey. Some idea of the magnitude of the work may be had from the following dimensions:

"The American shore line of the Great Lakes and their connecting rivers, if measured in steps of 25 miles, is about 3,000 miles, but if the indentations of the shore and the outlines of the islands be included the developed shore line is about 4,700 miles in length.

"Along rivers and where a lake is narrow it is necessary for navigation that both shores be mapped. This increases the length of the shore line to be surveyed between St. Regis, N. Y., and Duluth, Minn., to about 6,000 miles." [a]

During the first ten years of the survey, while a general geodetic survey of the entire chain of lakes was contemplated for the future, the actual operations were mainly confined to surveys of special localities where improvements were called for or where the navigation was difficult; and where the surveys were more extended they were little more than reconnaissances. This course was made necessary because the appropriations were inadequate to the purchase of the finer instruments and the support of the larger force necessary for more extensive and more exact surveys, and also because of the pressing need of improvements at particular localities, for which preliminary surveys were essential.

The execution of the survey involved a great quantity of astronomic, topographic, and hydrographic work, all of which was performed with a high degree of skill and accuracy. The result was the completion of a series of reliable charts for lake vessels and the furnishing of a basis for works of channel improvement upon the lakes themselves and their connecting waters.

The original series consisted of 76 charts, all of which were printed from copperplates. As a result of revisions, additions, and cancellations, there are now in force 81 lake-survey charts, of which 51 are printed in black from copperplates, 11 are lithographs in colors from copperplate transfers, 10 are lithographs in colors, and 9 are photo-lithographs in colors.

The charts issued in colors have all depths of 18 feet and less in blue, showing at a glance where vessels may proceed with safety, and are

[a] From memoranda respecting the lake survey, by Gen. C. B. Comstock, published in the Report of the Chief of Engineers for 1875.

considered by vessel men much preferable to the old style printed in plain black and white. This new series of colored charts is believed to constitute a distinct advance in chart construction and printing, and meets with high favor from navigators and others.

From 1882 to June 30, 1902, a total sum of $17,708.93 was derived from the sale of charts by the Detroit office and deposited in the United States Treasury.

Up to February 20, 1890, one full set of charts was issued free to each United States registered vessel. Any additional charts furnished such vessels and all furnished for other unofficial use were sold at the uniform price of 30 cents each. On the date above mentioned the free issue, except for official purposes of the Government, was discontinued, pursuant to law, and since then the charts have been sold for all private and unofficial use at prices ranging from 5 cents to 30 cents each, the price being intended in each instance to cover only the cost of paper and printing.

During the year the main work of the survey was conducted with skill and energy by Maj. Walter L. Fisk, Corps of Engineers, in charge of the principal office of the survey at Detroit, Mich. Nearly the whole work of conducting surveys and water-level observations, reducing the results thereof, and of correcting and issuing charts, was devolved upon that office. The district engineer officers rendered important aid by making local surveys and by regularly supplying valuable information for correcting the charts, bulletins, and supplements to the latter. These district officers are located at Duluth, Minn., Milwaukee, Wis., Chicago, Ill., Grand Rapids, Mich., Detroit, Mich., Cleveland, Ohio, and Buffalo, N. Y., with suboffices at Sault Ste. Marie, Mich., and Oswego, N. Y.

Charts may be purchased at the main office at Detroit, at the canal office at Sault Ste. Marie, Mich., and at the United States engineer office in Buffalo, N. Y. Complete sample sets may be seen at the United States engineer offices at Duluth, Minn., Milwaukee, Wis., Chicago, Ill., Cleveland, Ohio, and Oswego, N. Y., enabling purchasers to select exactly the charts they wish to order. It is hoped eventually to be able to furnish all the United States engineer offices mentioned with supplies of the charts for sale.

During the fiscal year ending June 30, 1902, the number of charts sold by the Detroit office was 9,892, and by the Buffalo office 820, the aggregate sales, 10,712, exceeding those of the preceding year by about 56 per cent; the proceeds of the sales amounted to $2,021.29, and were deposited to the credit of the Treasurer of the United States. The Detroit office issued 2,915 charts for official use and the Buffalo office 68, a total of 2,983. To date more than 253,500 of these charts have been sold and issued for actual service.

During the year important corrections and additions were made in the Detroit office to six of the old charts for use in the office of the Chief of Engineers in bringing the electrotype plates up to date from which, and other corrected plates, new editions of many of the charts have been printed in Washington.

Besides the above the Detroit office has, during the year, revised several other copperplates, transferred 11 copperplate charts to stone and published editions in colors therefrom, photolithographed 1 new chart in colors, and engraved on stone and issued in colors 8 entirely new charts.

On July 1, 1900, of the entire series of charts 5 were in colors; July 1, 1901, there were 12 in colors, and on July 1, 1902, the number so issued is 30.

There are now seven parties in the field, as follows:

One engaged on resurvey of the Apostle Islands and vicinity, Lake Superior; one on resurvey of northern Lake Michigan and the Straits of Mackinac; one connecting the United States lake survey system of triangulation in the vicinity of the mouth of St. Marys River with the Canadian triangulation along the north and northeast coasts of Lake Huron; one on the resurvey of the St. Lawrence River, which has long been greatly needed, as the work already done has developed many uncharted shoals and such extensive changes in topographic features, due to increase of population and commercial enterprises, that it will be necessary to get out an entirely new series of charts of that region; one party is observing the discharge of Lake Superior at the head of the rapids at Sault Ste. Marie, working from the International Bridge, and one is observing the discharge of the St. Clair and Detroit rivers.

The precise-level party has connected several bench marks of the Canadian canals with the precise levels on this side of the St. Lawrence River, thus making available a long series of water-level observations taken at the canals, and is now making a final connection between the Greenbush bench mark of the Coast and Geodetic Survey and the lake-survey bench marks at Oswego. As all the lakes have already been connected by precise levels, this Greenbush-Oswego line, with the new determination of the elevation above mean tide at New York of Greenbush bench mark now being made by the Coast and Geodetic Survey, will definitely fix the elevations of the Great Lakes above tide water.

Several local surveys and examinations were made to provide data for projecting new charts and correcting old ones. A considerable revision of the charts now under way has for its object to show to date certain changes which have taken place, due to natural and artificial agencies, to better serve the deeper draft vessels now engaged in lake commerce, and to indicate the somewhat reduced depths of water which now prevail during the season of navigation.

Many of the original charts were prepared with reference to a navigation calling for a draft not exceeding 12 feet. The soundings were referred to planes representing mean or average stages of water, and general depths exceeding 18 feet below such planes were not closely developed. Present conditions of commerce demand, however, that the bottom be accurately charted to depths of not less than 30 feet in the open lakes or 25 feet in their connecting rivers or straits, and these depths should relate to "low-water" stages instead of to the "mean stages" referred to above. This will call for extensive surveys and a vast quantity of office work, all of which must be done with great care and accuracy. To secure a satisfactory rate of progress will require an expenditure of at least $150,000 during the year ending June 30, 1904.

In addition to work relating to charts, the Detroit office continued operations during the year under the project adopted in 1898 for an exhaustive investigation of lake levels as described in the Annual Report of the Chief of Engineers for that year, pages 3774–3776. The principal field work comprised an accurate series of discharge measurements in the Detroit, St. Clair, and St. Lawrence rivers,

together with local surveys related to these measurements; also the maintenance of fourteen self-registering water gauges on the several lakes from Ontario to Superior and Michigan, which supply an accurate and continuous record of the most minute changes in the elevation of the water surface. The observations have been very satisfactory and are exceedingly valuable, fixing closely the discharges of all the Great Lakes for the stages prevailing at the time, but they should be continued until the lake elevations have varied through a much greater range than has occurred heretofore since they were undertaken. In Appendix E E E 1 will be found a table giving the discharges of all the Great Lakes at the mean stage of each for the past forty-two years as determined from the monthly means shown on the plate in the same appendix. This work is now fully organized, and it is highly important that it be pushed to completion as rapidly as possible. For this purpose the sum of $25,000 should be made available for expenditure during the fiscal year ending June 30, 1904.

It is therefore recommended that the appropriation for that year be made to include the two amounts indicated above, and that it be formulated as in the act of June 28, 1902, as follows:

Estimate for the fiscal year ending June 30, 1904.

For survey of Northern and Northwestern Lakes, including all necessary expenses for preparing, correcting, extending, printing, and issuing charts and bulletins, and of investigating lake levels with a view to their regulation, to be immediately available and to remain available until expended.....$175,000.00

SURVEYS, ADDITIONS TO, AND CORRECTING ENGRAVED PLATES.

July 1, 1901, balance unexpended		$134,420.41
June 30, 1902, amount expended during fiscal year		102,111.02
June 30, 1902, balance unexpended		32,309.39
Amount appropriated by sundry civil act June 28, 1902 (including printing and issuing charts)		150,000.00
July 1, 1902, balance unexpended		182,309.39

PRINTING AND ISSUING CHARTS.

July 1, 1901, balance unexpended		$1,463.19
June 30, 1902, amount expended during fiscal year	$971.02	
Reverted to Treasury	492.17	
		1,463.19

(See Appendix E E E 1.)

The lake survey triangulation has recently been adjusted to the standard geodetic datum of the United States Coast and Geodetic Survey. The results will be found printed in Appendix E E E 1. This important and valuable adjustment was rendered feasible at this time by the kind cooperation of Hon. Otto H. Tittmann, Superintendent of the Coast and Geodetic Survey.

Annual water levels of the Northern and Northwestern Lakes.—A table showing the monthly water levels from July 1, 1901, to June 30, 1902, at Charlotte and Oswego, N. Y., on Lake Ontario; at Erie Harbor, Pa.; Ashtabula and Cleveland, Ohio, on Lake Erie; at Milwaukee, Wis., on Lake Michigan, and Escanaba, Mich., on Green Bay; at Sand Beach, Mich., on Lake Huron, and Marquette and Sault Ste. Marie,

Mich., on Lake Superior, being a continuation of that published in the Annual Report of the Chief of Engineers for 1901, will be found in Appendix E E E 2.

Charts.—Under the supervision of this office during the fiscal year additions have been made to the engraved plates of—

Lake Superior, No. 2.
Lake Superior, No. 3.
North end of Lake Michigan.
South end of Green Bay, Lake Michigan.
Beaver Island Group, Lake Michigan.
Coast Chart No. 1, Lake Erie.
Coast Chart No. 3, Lake Erie.
Coast Chart No. 4, Lake Erie.
Coast Chart No. 6, Lake Erie.
Coast Chart No. 7, Lake Erie.
Sandusky Bay, Lake Erie.
Coast Chart No. 4, Lake Ontario.
St. Lawrence River, No. 5.
St. Lawrence River, No. 6.

Bulletins.—The series of bulletins, commenced in 1889, relating to the river and harbor improvements and navigation of the Great Lakes and connecting waters was greatly extended and improved during the year. The published numbers were as follows:

Bulletin 11 A, August 15, 1901.
Bulletin 11 B, August 31, 1901.
Bulletin 11 C, December 10, 1901.
Bulletin 11 D, September 14, 1901.
Bulletin 11 E, September 7, 1901.
Supplement No. 1 to Bulletin 11, September 16, 1901.
Supplement No. 2 to Bulletin 11, October 15, 1901.
Supplement No. 3 to Bulletin 11, December 5, 1901.
Bulletin 12 B, May 22, 1902.
Bulletin 12 C, April 29, 1902.
Bulletin 12 D, April 30, 1902.
Bulletin 12 E, April 28, 1902.

These bulletins and supplements give the latest and fullest descriptions of the progress in works of river and harbor improvements intended to benefit the navigation of the Great Lakes and their connecting waters, and of the results of surveys in those waters made under the direction of the Detroit office of the Lake Survey and the district engineer officers.

Survey of a portion of Milwaukee Bay, Wisconsin.—A survey was made and a map prepared of a portion of Milwaukee Bay, Wisconsin, extending from the North Point pumping station of the Milwaukee city waterworks to the Illinois Steel Company's plant and including the harbor of refuge and the entrance to the Milwaukee River. The results of the survey are embodied in the chart of Milwaukee Harbor, Wisconsin, prepared under the direction of Maj. Walter L. Fisk, Corps of Engineers, and issued March 20, 1902. The work was in the charge of Maj. James G. Warren, Corps of Engineers, and his report thereon will be found in Appendix E E E 3.

Survey of Northern and Northwestern Lakes.

July 1, 1901, balance unexpended (allotment)	$400.00
June 30, 1902, amount expended during fiscal year	390.14
July 1, 1902, balance unexpended	9.86

IMPROVEMENT OF THE YELLOWSTONE NATIONAL PARK, INCLUDING THE CONSTRUCTION, REPAIR, AND MAINTENANCE OF ROADS AND BRIDGES.

Officer in charge, Capt. Hiram M. Chittenden, Corps of Engineers.

The work has been in charge of the Engineer Department since 1883, except during the period from August, 1894, to March, 1899.

The present project, adopted August 27, 1900, modified by authority of the Secretary of War dated July 22, 1901, and further modified by authority of the Chief of Engineers dated May 29, 1902, embraces the following work:

(*a*) Belt line or main circuit, which includes all the important centers of interest in the park, viz, Mammoth Hot Springs, Norris Geyser Basin, the Firehole Geyser basins, the Yellowstone Lake, the canyon and falls of the Yellowstone, and the section near Tower Falls.

(*b*) Four approaches leading from the boundary of the park to different points on the belt line.

(*c*) Side roads to isolated objects of interest, as well as bridle trails for use by exploring parties and by troops and scouts in patrolling the Park.

(*d*) The macadamization, or thorough surfacing with best material available, of the belt line.

(*e*) The provisions of a sprinkling plant to keep down the dust on the main system.

(*f*) Extensive improvements at Mammoth Hot Springs, to be carried out in cooperation with the Quartermaster's Department.

The estimated total mileage of the completed system is about 306 miles in the park proper and 417 miles including the roads in the forest reserve.

On the project for the general road system there has been expended to June 30, 1902, the sum of $758,586.23, including annual maintenance and repairs. It is estimated that not less than $200,000 of this amount was expended in early work, which has since been replaced by other work, and does not therefore form a part of the completed system. Annual maintenance and repairs have cost over $200,000, leaving about $350,000 that has gone into permanent new work. The result of this expenditure (and of about $20,000 for a military road in the Teton Forest Reserve, now a part of the park road system) has been about 275 miles of road opened to travel. Of this amount, 45 miles were opened during the season of 1901. The number of bridges of all sizes built is about 120.

The work done under the last appropriation, including annual maintenance and repairs, was as follows:

New road opened in valley of Gardiner, replacing dangerous road under cliff. Includes three steel bridges.

About 1,600 feet of new road built on hill below Mammoth Hot Springs, replacing a 15 per cent grade with one of 8 per cent.

A single-track surrey road opened from Glen Creek to Middle Gardiner Falls, 2 miles.

One-fourth mile of very difficult construction in upper end of Golden Gate Canyon.

Entire length of road from Mammoth Hot Springs to Golden Gate resurfaced. Same stretch of road sprinkled throughout the season.

Water supply from Mammoth Hot Springs put in, including the construction of a ditch to carry the water of Glen Creek to Mammoth

Hot Springs, the construction of a reservoir holding 1,800,000 gallons, and the laying of a pipe line to connect with the points where supply is to be used.

The construction of about 7 miles of road near Yanceys, the grading of bridge approaches over the Yellowstone, and the survey of the proposed line as far as Tower Falls and through Granite Canyon, on the road to Cooke City.

The construction of 9 miles of road between the Thumb and Lake Hotel to cut out the Lake Shore road.

Construction of 12 miles of road on the eastern approach, carrying that road into the valley of Middle Creek beyond Sylvan Pass. This work includes the construction of new pile bridges over Yellowstone River and Pelican Creek.

The opening of 6 miles of road near Jackson Lake and the extensive reconstruction of the southern approach, including new bridges over Lewis River and Crawfish Creek, placing this road in very fair condition from Yellowstone Lake to Buffalo Fork of Snake River, the western terminus of the Fort Washakie military road.

The annual repairs have been extensive and have covered the entire existing system. Extensive resurfacing has been done near Norris, in the Lower Geyser Basin, and on the Continental Divide road. About 200,000 feet of lumber has been manufactured both for new work and the repairs of old bridges. The station houses throughout the Park have been placed in repair.

By the terms of the sundry civil act of June 28, 1902, Congress has adopted the approved project for the work and has made provisions for its completion, including also annual maintenance and repairs, at the rate of $250,000 per year for three years.

For full details as to operations of the past fiscal year, see the report of the officer in charge.

July 1, 1901, balance unexpended	$88,184.47
Amount appropriated by sundry civil act approved June 28, 1902	250,000.00
	338,184.47
June 30, 1902, amount expended during fiscal year	81,793.96
July 1, 1902, balance unexpended	256,390.51
July 1, 1902, outstanding liabilities	6,390.51
July 1, 1902, balance available	250,000.00
Amount (estimated) required for completion of existing project	500,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902:	
For works of improvement and for maintenance of improvement	250,000.00

(See Appendix F F F.)

RECONNAISSANCES, EXPLORATIONS, AND WORK IN THE FIELD.

Engineer officers and acting engineer officers on the staffs of commanding generals of military divisions and departments have been engaged during the year in building and repairing wagon roads and bridges, making surveys in the field, making and distributing maps, and in other duties incidental to the work of engineers in the field.

Reports of such work have been submitted by the following officers:

Lieut. Col. Oswald H. Ernst, Corps of Engineers, at the Department of the Lakes.

Lieut. Col. David P. Heap, Corps of Engineers, at the Department of California.

Lieut. Col. Charles E. L. B. Davis, Corps of Engineers, at the Division of the Philippines.

Maj. Smith S. Leach, Corps of Engineers, at the Department of the Missouri.

Capt. Charles S. Riché, Corps of Engineers, at the Department of Texas.

Capt. Francis R. Shunk, Corps of Engineers, at the Department of the East.

First Lieut. Burton J. Mitchell, Twelfth United States Infantry, at the Department of the Colorado.

Lieut. Col. Oswald H. Ernst, Corps of Engineers, engineer officer, Department of the Lakes, reports that in compliance with paragraph 14, Special Orders, No. 177, Adjutant-General's Office, July 31, 1901, he reported as engineer officer to the commanding general Department of the Lakes, August 20, 1901; that Capt. John J. Bradley, Fourteenth United States Infantry, aide-de-camp, was previously acting engineer officer. In compliance with instructions from the department commander, a survey was commenced of two tracts of land of about 3,200 acres each, one tract situated in McHenry and Nunda townships, McHenry County, Ill., the other in those townships and partly in Wauconda Township, Lake County, Ill. The field work was finished June 30, 1902, and the construction of the maps is now in progress. The usual routine work was performed in the office; maps were furnished for the information of the officers at the headquarters and in the department, and surveying instruments were issued to acting engineer officers at posts in the department upon requisition. A large number of maps relating to other departments were sent to the departments to which they pertained.

(See Appendix G G G 1.)

Lieut. Col. David P. Heap, Corps of Engineers, engineer officer, Department of California, reports that he was announced as engineer officer of the department by General Orders, No. 31, Headquarters Department of California, November 18, 1901, and in compliance with paragraph 9, Special Orders, No. 261, Headquarters of the Army, Adjutant-General's Office, series of 1901; that the principal work in the office was the care and preservation of the instruments and material for surveys and reconnaissances in the department and of the distribution of same to officers stationed therein; the mounting and preparing of maps, and the distribution of maps of the Philippine Islands to officers and organizations about to start to those islands. The field work mainly consisted in the survey of a proposed road from Fort Baker to Sausalito, Cal., and the preparation of profiles and estimates of same (the road is being constructed by military prison labor); the surveying of a proposed road at Alcatraz Island, California, with profiles and sections. This road also is being constructed by military prisoners. An inspection and report on the fences and other matters connected with the Monterey Military Reservation, Cal., were made.

(See Appendix G G G 2.)

Officers in charge of the Engineer Department, Division of the Philippines: Maj. Clinton B. Sears, Corps of Engineers, to March 12, 1902; since that date, Lieut. Col. Charles E. L. B. Davis, Corps of Engineers.

Officers on duty as assistants to the division engineer: Maj. Clinton B. Sears, Corps of Engineers, since March 12, 1902; Capt. William E. Craighill, Corps of Engineers, to July 11, 1901; Capt. Henry Jervey, Corps of Engineers, since July 24, 1901; First Lieut. Alvin K. Baskette, Third Infantry, to July 22, 1901; First Lieut. George E. Stewart, Fifteenth Infantry, to December 1, 1901; Second Lieut. Arthur Williams, Corps of Engineers, since July 22, 1901.

Engineer officer, Department of Northern Luzon: Capt. George A. Zinn, Corps of Engineers, to September 20, 1901; First Lieut. Lytle Brown, Corps of Engineers, to the consolidation of this department with that of Southern Luzon, December 1, 1901.

Engineer officer, Department of Southern Luzon: First Lieut. Sherwood A. Cheney, Corps of Engineers, to July 24, 1901; Capt. William W. Harts, Corps of Engineers, to December 1, 1901.

Engineer officer, Department of North Philippines, Capt. William W. Harts, Corps of Engineers, since December 1, 1901.

Engineer officer, Department of the Visayas, Capt. Robert McGregor, Corps of Engineers, from September 3, 1901, to the consolidation of this department with that of Mindanao and Jolo, November 30, 1901.

Engineer officer, Department of Mindanao and Jolo, Capt. Jay J. Morrow, Corps of Engineers, from September 4, 1901, to December 1, 1901.

Engineer officer, Department of South Philippines, Capt. Robert McGregor, from December 1, 1901.

I. FIRST AND SECOND BATTALIONS OF ENGINEERS.

On July 10, 1901, Company A, First Battalion of Engineers, was relieved from duty in the Philippines and ordered to the United States, and on September 20, 1901, the remaining companies, B, C, and D, of this battalion were relieved and returned to the United States.

The various officers and detachments of this battalion scattered through the provinces were relieved by officers and detachments from the Second Battalion of Engineers, which had arrived at Manila July 16, 1901, under command of Capt. Henry Jervey, Corps of Engineers, who retained command until July 24, 1901, when he was relieved of the command by Capt. William W. Harts, Corps of Engineers, who in turn was relieved of the command February 1, 1902, by Maj. Clinton B. Sears, Corps of Engineers, under paragraph 19, Special Orders, No. 296, Adjutant-General's Office, December 23, 1901.

The strength of the battalion on its arrival was 14 officers and 402 enlisted men.

The maximum strength (in October, 1901) has been 14 officers and 488 enlisted men.

By authority of the Secretary of War, the authorized enlisted strength of the battalion serving in the Philippines was increased from 104 to 164 enlisted men to each company.

By paragraph 4, Special Orders, No. 145, Headquarters Division of the Philippines, June 19, 1902, the following engineer officers were attached to the companies of the Second Battalion of Engineers:

First Lieut. William Kelly and Second Lieut. George R. Spalding to Company E.

First Lieut. Lytle Brown and First Lieut. Curtis W. Otwell to Company F.

First Lieut. John R. Slattery and First Lieut. Hubert L. Wigmore to Company G.

First Lieut Lewis H. Rand and Second Lieuts. Clarence O. Sherrill and Second Lieut. William G. Caples to Company H.

The headquarters of Companies E and H have been at Malate Barracks, Manila, as also were Companies F and G, until August 31, 1901, when these companies left Manila and took station, Company F at Iloilo, and December 30, 1901 at Cebu, and from May 18, 1902, at Malabang, Mindanao. Company G at Zamboanga, Mindanao, and since May 18, 1902, at Malabang, Mindanao.

The duties of the battalion during the year have been principally surveys, topographical and hydrographical, reconnaissance, and the construction and repair of roads and bridges, for which purpose its officers have been assigned to districts and the enlisted men scattered throughout the archipelago in detachments.

II. OFFICE WORK AND SUPPLY DEPARTMENT.

The office work has been the usual routine incident to the administration of the departments—of mapping, blue printing, and photography; the construction and repair of roads and bridges, and the improvement of the port of Manila and the Pasig River. Large quantities of road and bridge supplies have been purchased and shipped to the district officers in the islands or shipped from stock on hand at the depot in Manila.

III. MAP WORK.

The compilation of maps and reconnaissance sketches has been continued throughout the year, and seven new maps have been prepared. Five thousand four hundred maps, mostly blue prints, have been distributed to officers serving in the Philippines. A marked decrease in the number of maps asked for has followed the cessation of active field operations.

IV. ROADS AND BRIDGES.

This work has been carried on under an appropriation from insular funds, act No. 1, United States Philippine Commission, $2,000,000 Mexican, and has been in continuation, betterment, and extension of the work of the previous year. The appropriation is nearly exhausted, and the work will be discontinued at an early day, leaving the future care of the roads and bridges to the provincial authorities, to whom the plant purchased from insular funds has been or will be transferred.

V. MANILA HARBOR AND THE PASIG RIVER.

The improvement of Manila Harbor and the Pasig River is being carried out with insular funds, consisting of a continuous appropriation, not to exceed $3,000,000 United States currency, of which $1,000,000 has been actually appropriated.

The approved project is the building of a timber and stone bulkhead from the canal entrance near the mouth of the Pasig River, parallel to the Malecon drive and about 2,000 feet therefrom, to the intersection of the south jetty, which is to be prolonged, with riprap foundation and masonry superstructure; the dredging out of the harbor basin behind the breakwater to a depth of 30 feet, and the filling in of the dredged material behind the bulkhead to a level of 10 feet

above low water; the completion and extension of the present breakwater; the deepening of the canal; the dredging of the bar at the mouth of the Pasig, and of the latter as far as the Bridge of Spain, to a depth of 18 feet (mean low water), and the dredging of the Upper Pasig to give a 6-foot low-water navigation.

The harbor work is being done by contract with the Atlantic, Gulf and Pacific Company to the amount of $2,150,000, to be completed in three years from May 1, 1902, and the Pasig River work is being done by day labor and the use of the plant owned and being built by the insular government.

In the harbor work the contractors have completed the building of their offices, shops, warehouse, etc., have opened extensive quarries at Mariveles, and have assembled a large amount of floating and stationary plant. They have built 1,093 linear feet of bulkhead and deposited 18,131 tons of riprap rock.

On the bar and in the river 472,804 cubic yards of dredging has been done, at an average cost of 6.37 cents per cubic yard for labor, fuel, current repairs, etc.

Nothing has been done in the Upper Pasig except the building of a large portion of the plant.

VI. EXPENDITURES.

FUNDS ALLOTTED BY THE CHIEF OF ENGINEERS, UNITED STATES ARMY.

"Civilian Assistants to Engineer Officers, 1902"	$5,098.50
"Equipment of Engineer Troops, 1902"	2,782.44
"Sites for Fortifications and Seacoast Defenses"	1,252.94
Total (United States currency)	9,133.88

INSULAR FUNDS.

	Mexican currency.
"Repairs to roads and bridges, Philippine Islands"	$846,151.25
Calamba-Batangas road	90,000.00
	U. S. currency.
Improvement of the port of Manila	$364,462.18
Survey, harbor of Iloilo	5,000.00
Survey of Cagayan River	2,984.43

VII. GENERAL REMARKS.

The whole official force of the engineer department in the Philippines—officers, enlisted men, and civilian employees—has been fully occupied throughout the year, working full daily hours the same as in the United States, and has accomplished in the given time far more than was ever done under the former government.

The department is still handicapped, however, by lack of sufficient officers and men to answer the numerous and various calls made upon it by the military and insular authorities.

(See Appendix G G G 3.)

Maj. Smith S. Leach, Corps of Engineers, engineer officer, Department of the Missouri, reports that he assumed charge of the engineer office of that department March 13, 1902, and relieved First Lieut. John McClintock, aide-de-camp; that the department commander, in General Orders, No. 14, of that department, March 28, 1902, promulgated a systematic scheme of engineering operations to be carried on at all garrison posts in the department, which scheme combined

the preparation of maps of posts and reservations, with the instruction of lieutenants in military topography and sketching. The latest and best data obtainable, to be used as a basis of work, have been sent to the different posts; six of the nine posts have submitted programmes of work. During the fiscal year issues of instruments and supplies have been made, property accountability maintained and adjusted, and calls for information met as far as possible. It is proposed to further develop the scheme of combining practical work with practical instruction by extending the fields of operations to territory contiguous to posts and to communication between the several posts. The preparation of a department map will be undertaken as soon as assistance can be obtained. This report was submitted to the adjutant-general of the Department of the Missouri.

(See Appendix G G G 4.)

Capt. Charles S. Riché, Corps of Engineers, took charge of the engineer office, Department of Texas, on May 5, 1902, per General Orders, No. 12, Department of Texas, 1902, relieving Capt. C. D. Roberts, Seventh Infantry, United States Army, but retaining station at Galveston, Tex. Since then Captain Roberts has given his attention to all matters at Fort Sam Houston that could not well be attended to from Galveston, and has rendered great assistance. The operations during the year have been only to supply troops with engineering material when required. A civilian assistant was appointed on May 16, 1902, with station at department headquarters, San Antonio, Tex. As soon as the office equipment of instruments, etc., en route at close of fiscal year, is received the office will be in a position to furnish copies of maps, etc., and to collate the information now on hand and that which is furnished from time to time by troops, and also to continue work on the progressive military map of Texas.

(See Appendix G G G 5.)

Capt. Francis R. Shunk, Corps of Engineers, engineer officer, Department of the East, reports that he relieved Capt. Clement A. F. Flagler, Corps of Engineers, May 12, 1902, who was previously the engineer officer of that department; that the work consisted in the preparation of numerous maps, reports, and final records relating to the road work completed in the previous fiscal year; the issue of instruments and materials for the use of troops on practice marches; care of instruments and other property, and the supervision of reconstruction of steamship pier in San Juan Harbor.

(See Appendix G G G 6.)

First Lieut. Burton J. Mitchell, Twelfth United States Infantry, acting engineer officer, Department of the Colorado, reports that Capt. Delamere Skerrett, acting judge-advocate, United States Army, was in charge of the engineer office from July 1 to August 30, 1901, and Maj. Charles A. Varnum, Seventh United States Cavalry, from August 7, 1901, to June 30, 1902; that the office has been without a permanent clerk since October 10, 1900, the clerical work being performed by the clerk in the offices of the inspector of small arms practice and ordnance officer. The services of a competent topographical assistant are much needed to prepare new maps, care for engineering instruments, maps, etc. The usual routine office work, requiring no special comment, was performed during the year.

(See Appendix G G G 7.)

ESTIMATE FOR AMOUNT REQUIRED FOR MAPS, INCLUSIVE OF WAR MAPS.

For publication of maps for use of the War Department, inclusive of war maps, $5,000.

Paragraph 393 of the Army Regulations requires that the commanding officer of each post where there are fixed batteries bearing upon a channel will call upon the Engineer Department for accurate charts showing the soundings to the extent of the ranges of the guns. Calls upon this Department to perform its duty under this regulation are now being honored as rapidly as possible. To further the work $5,000 should be appropriated for the fiscal year ending June 30, 1903.

NEW BUILDING FOR GOVERNMENT PRINTING OFFICE.

Officer in charge, Capt. John S. Sewell, Corps of Engineers; assistant, Lieut. Clarke S. Smith, Corps of Engineers, since September 19, 1901.

This building was authorized under the sundry civil act approved March 3, 1899, and its limit of cost was increased from $2,000,000 to $2,429,000 by a joint resolution approved February 17, 1900. For the wording of these acts and a report of operations up to June 30, 1901, reference is made to the Annual Report of the Chief of Engineers for 1901, Appendix H H H.

Since the date of the last report the steel work has been entirely finished, except some small quantities that had to be left out of the hoistways needed for construction purposes; the fireproofing has been entirely completed, with the exception of about half of the ceiling slabs and some odds and ends that have to be left to the last; the exterior walls have been finished, and the interior partitions about 80 per cent finished.

Nearly all the door and window frames are in place; the roof is weather tight and probably half finished, and a good beginning has been made on the plastering and on leveling up the floor arches to receive the hard-wood and mosaic floors. Contracts have been let for everything needed to finish the entire building, except the marble work, furring, and bronze work of the principal entrance and executive offices, and the finished sidewalk on the G street and North Capitol street fronts.

The unusual amount of cold weather during the past winter and unavoidable delays in securing materials have made it impossible to finish the building as soon as indicated in the last annual report. It is possible, however, that it will be completed in all respects some time in December, 1902. The prospects still are that it will be finished within the limit of cost, with a small margin to spare.

The present condition of the appropriation is as follows:

Amount appropriated by act of March 3, 1899		$350,000.00
Amount appropriated by act of June 6, 1900		775,000.00
Amount appropriated by act of March 3, 1901		1,304,000.00
		2,429,000.00
June 30, 1902, amount expended to date		1,585,141.42
July 1, 1902, balance unexpended		843,858.58
July 1, 1902, outstanding liabilities	$76,316.55	
July 1, 1902, covered by existing contracts	411,488.66	
		487,805.21
July 1, 1902, balance available		356,053.37

(See Appendix H H H.)

CONSTRUCTION OF MILITARY ROAD FROM FORT WASHAKIE TO MOUTH OF BUFFALO FORK OF SNAKE RIVER, WYOMING.

Officer in charge, Capt. Hiram M. Chittenden, Corps of Engineers.

The first appropriation for this work was made by act of June 4, 1897. Construction was commenced in August, 1898, and finished in October of the same year, so far as funds would permit. For description of the locality, character, and value of the road and work done to June 30, 1899, see Annual Report of the Chief of Engineers, 1899, Part IV, pages 3881–3900.

Amount expended to June 30, 1901, $18,367.85.

Amount expended during fiscal year ending June 30, 1902, $17.25.

The sundry civil act of June 6, 1900, appropriated $10,000 for repair and completion of the road. A project was submitted June 17, 1900, and approved June 22, 1900. Work began immediately after the 1st of July and continued until the 13th of September. It consisted entirely in completing and repairing the road built in 1898. The most important item of the work was the construction of a large bridge, 117 feet long, over Buffalo Fork of Snake River. In the month of October a reconnaissance was made along the Wind River Valley to determine the best location for a road along that stream, if there should be an appropriation for completing the road.

No work was done during the past fiscal year, except in the matter of preparation for the expenditure of the remaining balance during the current season.

July 1, 1901, balance unexpended	$1,632.15
June 30, 1902, amount expended during fiscal year	17.25
July 1, 1902, balance unexpended	1,614.90
July 1, 1902, outstanding liabilities	3.19
July 1, 1902, balance available	1,611.71

(See Appendix I I I.)

OFFICE OF THE CHIEF OF ENGINEERS.

During the fiscal year ending June 30, 1902, the following-named officers were on duty in this office as assistants:

Col. Alexander Mackenzie.
Lieut. Col. William R. Livermore, since June 3, 1902.
Maj. James L. Lusk.
Maj. Frederic V. Abbot.
Capt. Mason M. Patrick, since August 16, 1901.
Capt. Charles S. Bromwell.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

APPENDIXES

TO THE

REPORT OF THE CHIEF OF ENGINEERS,

UNITED STATES ARMY.

APPENDIXES

TO THE

REPORT OF THE CHIEF OF ENGINEERS,

UNITED STATES ARMY.

FORTIFICATIONS, ETC.

APPENDIX NO. 1.

REPORT OF THE BOARD OF ENGINEERS.

THE BOARD OF ENGINEERS, ARMY BUILDING,
New York City, July 10, 1902.

GENERAL: I have the honor to submit the annual report recounting the operations of The Board of Engineers for the year ending June 30, 1902.

The following changes in the personnel of the Board has taken place since the date of the last annual report:

Capt. Edgar Jadwin, Corps of Engineers, to enable him to take leave of absence granted by Special Orders, No. 192, Headquarters of the Army, Adjutant-General's Office, August 17, 1901, was relieved as recorder and disbursing officer of the Board on August 23, 1901, by Lieut. Edward H. Schulz, Corps of Engineers, who was relieved from this duty by Captain Jadwin on October 15, 1901.

By paragraph 2, Special Orders, No. 51, Headquarters of the Army, Adjutant-General's Office, March 1, 1902, Capt. Edgar Jadwin, Corps of Engineers, was relieved by Lieut. Edward H. Schulz, Corps of Engineers, as recorder and disbursing officer of the Board on March 15, 1902.

On June 30, 1902, The Board of Engineers consisted of the following-named officers: Col. Charles R. Suter, Corps of Engineers, President; Col. Samuel M. Mansfield, Corps of Engineers; Lieut. Col. Charles W. Raymond, Corps of Engineers; Maj. Sedgwick Pratt, Artillery Corps, and Lieut. Edward H. Schulz, Corps of Engineers, recorder and disbursing officer.

In addition, Col. Peter C. Hains, Corps of Engineers, Division Engineer of the Southeast Division, Lieut. Col. Oswald H. Ernst, Corps of Engineers, Division Engineer of the Northwest Division, Lieut. Col. David P. Heap, Corps of Engineers, Division Engineer of the

Pacific Division, Lieut. Col. William H. Heuer, Division Engineer of the Northern Pacific Division, and Lieut. Col. Henry M. Adams, Division Engineer of the Gulf Division, are members of The Board of Engineers when matters pertaining to defensive works in their respective divisions are under consideration by the Board.

In the past fiscal year the following officers of the Corps of Engineers, in charge of engineering districts, have been associated with the Board during the consideration of certain subjects: Maj. George W. Goethals, defenses of Narragansett Bay; Maj. Solomon W. Roessler, Capt. Harry Taylor, and Capt. Spencer Cosby, revision of type plans for chain ammunition hoists.

The Board has considered the various subjects referred to it during the past fiscal year by the Chief of Engineers, and the following is a brief summary of the reports rendered thereon:

1901.

July 2. On advisability of providing steel doors and shutters to range-finder houses for high sites.

July 2. On armament for Fox Hill, Rhode Island, in connection with revision of project for defense of Narragansett Bay.

July 9. Revised project for defense of Narragansett Bay.

July 9. On estimate of Capt. Thomas H. Rees, Corps of Engineers, for three 3-inch rapid-fire guns west of Martello Tower, Key West, Fla.

July 9. Annual report recounting the operations of The Board of Engineers for the fiscal year ending June 30, 1901.

July 13. Revised project for defense of the mouth of the Columbia River, Oregon and Washington.

July 26. Relative to the need of certain military reservations near Tacoma, Wash.

July 26. Completed drawings for front-delivery chain hoist adapted for use in emplacements for 10-inch B. L. rifle.

July 26. Tracing showing locations of guns in position at Port Royal Sound, South Carolina.

July 30. Revised project for defense of Tampa, Fla.

Aug. 2. On inspection report of Maj. W. L. Marshall, Corps of Engineers, of fortifications in New York Harbor, with special reference to dampness in magazines.

Aug. 2. On revision of project for defense of Pensacola, Fla.

Aug. 2. On strategic value of American Lake, Washington, for location of an artillery post.

Aug. 8. On revision of project for defense of Boston, Mass., with maps to illustrate the same.

Aug. 10. On location of proposed defensive works at Nortons Point, Coney Island, New York.

Aug. 14. On revision of project for defense of Charleston, S. C.

Aug. 28. On communication from Ordnance Department of August 10, 1901, relative to height of parapet for 3-inch rapid-fire guns on pedestal mount.

Aug. 28. On scheme of B. W. Thompson for "fire walls for fortified positions."

Aug. 28. On modified plan of Maj. James B. Quinn, Corps of Engineers, of July 22, 1901, for emplacements for two 6-inch rapid-fire guns at Fortress Monroe, Va.

Sept. 10. On location of searchlight projectors on top of range-finder towers.

Sept. 13. On improved system of ammunition lifts at 10-inch battery, Charleston, S. C.

Sept. 13. On sufficiency of ammunition-delivery service provided in new type plans for rapid-fire guns.

Sept. 13. On proposed purchase of land at Sabine Head, in defenses of Kennebec River, Maine.

Sept. 13. On use of photography in future military operations.

Sept. 13. On completion of 12-inch battery at Fort Sumter, S. C.

Sept. 26. On tracing showing area of reservation and general location of proposed batteries for defense of Tampa, Fla.

Sept. 26. On tracing showing area of reservation and general location of proposed batteries for defense of San Francisco, Cal.

Sept. 28. On type design for range-finder tower on low site.

Oct. 5. Modification in delivery table, 12-inch hoist.

1901.
Oct. 9. Modification of type emplacement for 10-inch disappearing carriage, model 1901.
Oct. 9. Ammunition service for the 6-inch rapid-fire gun.
Oct. 9. Submarine-mine defense of the Penobscot River, Maine.
Oct. 9. Submarine-mine defense of the Kennebec River, Maine.
Oct. 15. Drawings to illustrate revised projects for defense of Pensacola and Tampa, Fla.
Nov. 7. Relative to a consideration of the armament for Martello tower, Key West, Fla., in connection with revision of project for defense of that harbor.
Nov. 7. Recommendations of Major Quinn for change in location of armament at Fortress Monroe, Va.
Nov. 7. Substitution of chain hoists for platform lifts at Fort Mott, N. J.
Nov. 9. Report of Captain Cosby on ammunition delivery in 12-inch battery at Fort Morgan, Ala.
Nov. 13. Foundations proposed by Captain Riché at Forts San Jacinto, Crockett, and Travis, Galveston, Tex.
Nov. 14. Anchorage for pedestal, 3-inch Driggs-Seabury casemate mount.
Dec. 6. On project and estimate for the defense of Pearl and Honolulu harbors.
Dec. 6. Proposal of Board of officers constituted by Special Orders, No. 238, Headquarters of the Army, Adjutant-General's Office, October 15, 1901, to transfer the four 5-inch rapid-fire guns projected for Lobos Creek to Bakers Beach, San Francisco, Cal.
Dec. 6. Modification in type drawings for range-finder towers on low sites.
Dec. 6. Revised project for defense of San Francisco, Cal.
Dec. 10. Changes suggested by Capt. James J. Meyler, Corps of Engineers, in ammunition hoists.
Dec. 10. On report of Lieut. Col. J. P. Story, Artillery Corps, relative to sites for position finders at Narragansett Bay.
Dec. 21. Relative to test of 6-inch chain hoist at Fort Wadsworth, N. Y., with report of Capt M. C. Buckey, Artillery Corps, on same.
Dec. 21. Revised project for defense of the southern entrance to New York Harbor.
Dec. 21. Acquisition of land at Nortons Point, Coney Island, New York, for defensive purposes.
Dec. 21. Acquisition of land near Princess Bay light, Staten Island, New York, for defensive purposes.

1902.
Jan. 14. Revision of type plans for chain hoists.
Jan. 18. On best type of mount for 6-inch gun.
Jan. 24. Drawings to illustrate the Board's revised project of August 14, 1901, for defense of Charleston, S. C.
Jan. 28. On recommendation of Capt. E. M. Weaver, Artillery Corps, relative to mechanical ammunition delivery.
Feb. 3. Artillery defense of San Juan, P. R.
Feb. 13. Design of Major Roessler for 8-inch chain hoist.
Feb. 14. Design for range-finder tower for high sites.
Feb. 15. Recommendation for hoists at Fort Screven, Ga.
Feb. 15. Plan of Maj. J. B. Quinn, Corps of Engineers, for ammunition hoists for batteries at Fort Monroe, Va.
Feb. 18. Recommendation to install, for testing purposes, the Pullman Automatic Ventilator Company's system at Fort Wadsworth, N. Y., and Fort Banks, Boston, Mass.
Feb. 21. Recommendation of changes in Hodges front-delivery chain hoist.
Feb. 21. Relative to trial test of design of Captain Taylor for 10-inch chain hoist.
Feb. 21. Substitution of copper for slate roofs on peace storage magazines.
Mar. 24. Outline of organization for observing the combined naval and military maneuvers in Long Island Sound and Narragansett Bay during 1902.
Apr. 1. Arrangement of armament at Fort Totten, N. Y.
Apr. 1. Supplemental report and drawings on 10-inch chain ammunition hoist, rear delivery.
Apr. 18. Increase in depth of well, 10-inch emplacement.
Apr. 24. Change in angle of obliquity for gear teeth, 10-inch chain ammunition hoist.
Apr. 24. Installation of electric plants for Forts Banks and Heath, Mass.
Apr. 24. Defense of Manila and Subig bays, Philippine Islands.
Apr. 24. Revision of project for defense of the eastern entrance to Long Island Sound.
May 6. Alterations and additions 10-inch chain hoist front delivery.
May 13. Design of Mr. D. E. Hughes, assistant engineer, for chain ammunition hoists.

1902.
May 13 and 31. Relative to stations for engineer troops and observers during coming maneuvers in Narragansett Bay and Long Island Sound.
May 17. Alterations and additions 8-inch chain hoist.
May 31. On recommendation of Capt. Harry Taylor, Corps of Engineers, that main gear wheels of chain ammunition hoists be made of cast iron instead of with bronze rims.
May 31. On acquisition of land at Deer Island, Boston Harbor, for defensive purposes.
June 13. On assignment of officers of the Corps of Engineers for duty as observers during coming maneuvers in Narragansett Bay and Long Island Sound.
June 13. Alterations and additions in type plans for 8-inch and 10-inch chain ammunition hoists.
June 14. Revised type emplacement for 12-inch B. L. rifle, model 1900, on disappearing carriage, model 1901.
June 18. Safety firing key, invented by Lieut. Col. D. P. Heap, Corps of Engineers, for use in mortar batteries.
June 19. Advisability of transfer of part or whole of the armament at Fort Armistead to other localities for the defense of Baltimore, Md.
June 26. Revised project for defense of Puget Sound.

The following personal inspections of fortifications and defensive sites were made by the Board in the past fiscal year:

On August 12 and 13, 1901, eastern entrance to Long Island Sound; authority Chief of Engineers, August 3, 1901.

On August 29, 1901, Narragansett Bay; authority Chief of Engineers, August 3, 1901.

On September 5, 6, and 7, 1901, Portland Harbor and Forts Popham and Knox, Me.; authority Chief of Engineers, August 31, 1901.

On September 18, 1901, Delaware River; authority Chief of Engineers.

On October 3, 1901, Delaware River; authority Chief of Engineers, October 1, 1901.

On October 9, 1901, Fort Wadsworth, N. Y.; on October 10, 1901, Fort Hancock, N. J.; and on October 16, 17, and 18, 1901, Boston, Mass., and Portsmouth, N. H.; authority Chief of Engineers, October 12, 1901.

On October 29, 1901, the Board, accompanied by the district engineer, Maj. W. L. Marshall, Corps of Engineers, made an inspection of fortifications at Fort Hamilton, N. Y., and also inspected sites suggested for emplacement of armament at Nortons Point, Coney Island.

On November 20, 1901, the Board witnessed a test of ammunition hoist for 6-inch rapid-fire gun on disappearing carriage at Fort Wadsworth, N. Y., and on the same date made an inspection of suggested sites for emplacement of armament at Red Bank, near Seguines Point and Wards Point, Staten Island, N. Y.

On March 25 and 26, 1902, Lieut. Edward H. Schulz, Corps of Engineers, recorder of The Board of Engineers, made an inspection of defensive sites at the eastern entrance to Long Island Sound; authority Chief of Engineers, March 26, 1902.

On April 11, 1902, eastern entrance to Long Island Sound; authority Chief of Engineers, April 9, 1902.

In addition to their duties with the Board of Engineers, the officers composing the same have been otherwise engaged during the period they have been members in the past fiscal year, as follows:

Col. Charles R. Suter, Corps of Engineers, the president of the Board, continues as division engineer of the Northeast Division and as president of Board on harbor lines for the harbor of New York and adjacent waters, and of Board for the examination of officers of the Corps of Engineers with a view to their promotion. He also served

as president of Board for the examination of officers of the line of the Army with a view to their transfer to the Corps of Engineers, and of a Board to consider and report upon the subject of examinations for promotion of officers of the Corps of Engineers.

Col. S. M. Mansfield, Corps of Engineers served as division engineer of the Northwest Division until July 25, 1901, when he became division engineer of the Eastern Division, and continues on this duty. He has charge of the improvements of Hudson, the Harlem, and the East rivers, New York, and various works in and about New York City, the supervision of bridges and the removal of wrecks. He is a member of the Board on harbor lines for New York and its adjacent waters, and also of a Board for the examination of officers of the Corps of Engineers with a view to their promotion. Until February 1 he was also in charge of the improvement of certain rivers and harbors in northern New Jersey and on Long Island, N. Y.

Lieut. Col. C. W. Raymond, Corps of Engineers, was in charge of works of defense of Delaware River and certain rivers and harbors in Delaware and New Jersey while stationed at Philadelphia, Pa., until October 1, 1901. He continued in charge of construction of harbor of refuge, Delaware Bay, Delaware, until June 12, 1902, and was in charge of improvement of rivers and harbors and the supervision of various bridges in the States of New York and New Jersey from February 1, 1902, until June 12, 1902, when he was temporarily relieved. He was also a member of a Board to consider and report upon the subject of examinations for promotion of officers of the Corps of Engineers. He is a member of the Board on harbor lines for the harbor of Philadelphia. He is also delegate to the Ninth International Navigation Congress, held in Düsseldorf, Germany, June, 1902, and is a member of the Permanent International Commission of the Congresses of Navigation and membre titulaire for the United States on the executive committee of the commission.

Maj. Sedgwick Pratt, Artillery Corps, is stationed at Fort Wadsworth, N. Y., and continues in the performance of his duties at that post. He has also been a member of the Board of Ordnance and Fortification since April 2, 1902.

Lieut. Edward H. Schulz, Corps of Engineers, served temporarily as recorder and disbursing officer of The Board of Engineers from August 23, 1901, to October 15, 1901. On March 15, 1902, he relieved Capt. Edgar Jadwin, Corps of Engineers, permanently from this duty, under paragraph 2, Special Orders, No. 51, Headquarters of the Army, Adjutant-General's Office, March 1, 1902. In addition, he was on duty at New London, Conn., under the immediate orders of Maj. Smith S. Leach, Corps of Engineers, from July 1 to August 22, 1901, and from October 15 to November 5, 1901. In command of Engineer Depot at Willets Point, N. Y., since November 6, 1901, under paragraph 25, Special Orders, No. 242, Headquarters of the Army, Adjutant-General's Office, October 19, 1901. He also served as a member of the Board for the examination of officers of the line of the Army with a view to their transfer to the Corps of Engineers.

For the Board:

Very respectfully, your obedient servant,

CHAS. R. SUTER,
Colonel, Corps of Engineers, President of the Board.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.



APPENDIX No. 2.

FORTIFICATIONS.

FISCAL YEAR 1901–1902.

2 A.

DEFENSES OF COAST OF MAINE.

Officer in charge, Maj. Solomon W. Roessler, Corps of Engineers; assistant, Lieut. (now Capt.) Charles W. Kutz, Corps of Engineers, until October 31, 1901; Division Engineer, Col. Charles R. Suter, Corps of Engineers.

BAR HARBOR, ME.

Two 8-inch converted rifles and two 10-inch smoothbore guns were mounted on temporary wooden platforms in 1898. These obsolete defenses have been dismantled by the sale of the two smoothbore guns and one of the converted rifles and the transfer of the rest of the material.

PENOBSCOT RIVER, MAINE.

One of the finest examples of the casemated type of forts is located on the reservation. A repointing of much of the masonry and a damp-proof cover over the casemated portion of the fort will be required to preserve it from destruction by frost. The fort is ungarrisoned. The only modern building on the place is a storehouse for submarine-mining material. This material was overhauled during the year.

The project for the defense of this point by a modern armament is under revision.

Money statements.

PRESERVATION AND REPAIR OF FORTIFICATIONS.

July 1, 1901, balance unexpended	$518.18
June 30, 1902, amount expended during fiscal year	166.51
July 1, 1902, balance unexpended	351.67
July 1, 1902, outstanding liabilities	1.73
July 1, 1902, balance available	349.94

TORPEDOES FOR HARBOR DEFENSE.

July 1, 1901, balance unexpended	$585.37
June 30, 1902, amount expended during fiscal year	75.46
July 1, 1902, balance unexpended (deposited)	509.91

ALLOTMENTS.

Preservation and repair of fortifications.

July 19, 1898, act of May 7, 1898	$600

Torpedoes for harbor defense.

July 13, 1900, act of May 25, 1900	$3,000

KENNEBEC RIVER, MAINE.

The fort contains one 8-inch B. L. rifle mounted on 15-inch smoothbore carriage. Only the most urgent repairs have been made during the year. The submarine-mining material is stored in a temporary wooden storehouse in the area of the old fort.

The present reservation being insufficient to afford site for a modern armament, the United States purchased, in 1902, an additional tract of land for this purpose.

Money statements.

PRESERVATION AND REPAIR OF FORTIFICATIONS.

July 1, 1901, balance unexpended	$438.72
June 30, 1902, amount expended during fiscal year	249.66
July 1, 1902, balance unexpended and available	189.06

SITES FOR FORTIFICATIONS AND SEACOAST DEFENSES.

Allotted October 17, 1901	$16,000.00
Withdrawn February 1, 1902	5,950.00
	10,050.00
June 30, 1902, amount expended during fiscal year	10,002.45
July 1, 1902, balance unexpended (deposited)	47.55

ALLOTMENTS.

Preservation and repair of fortifications.

July 24, 1899, act March 3, 1899	$1,200.00

Sites for fortifications and seacoast defenses.

October 17, 1901, act March 1, 1901	$10,050.00

PORTLAND, ME.

Fort Gorges, Me.—No work was done during the fiscal year. A watchman was on duty throughout the year. All the armament has been removed.

Money statement.

PRESERVATION AND REPAIR OF FORTIFICATIONS.

July 1, 1901, balance unexpended	$859.00
June 30, 1902, amount expended during fiscal year	647.67
July 1, 1902, balance unexpended	211.33
July 1, 1902, outstanding liabilities	50.00
July 1, 1902, balance available	161.33

ALLOTMENTS.

June 7, 1900, act May 25, 1900	$800.00
May 10, 1901, act March 1, 1901	600.00

Fort Scammel, Me.—No work was done during the past fiscal year. The old armament was condemned and sold, and, while in process of demolition and removal by the purchaser, a man has been sent to the fort to see that no damage was done to the work.

Money statement.

PRESERVATION AND REPAIR OF FORTIFICATIONS.

July 1, 1901, balance unexpended	$385.83
June 30, 1902, amount expended during fiscal year	298.42
July 1, 1902, balance unexpended	87.41
July 1, 1902, outstanding liabilities	8.20
July 1, 1902, balance available	79.21

ALLOTMENTS.

October 4, 1898, act May 7, 1898	$500.00
June 9, 1899, act May 7, 1898	250.00

SITE NO. 1.

Battery for sixteen 12-inch B. L. mortars.—The shell rooms and magazines have been lined to reduce the moisture, which at times appeared in troublesome quantity. This work was in progress at the beginning of and was completed during the fiscal year. The lining overhead consists of galvanized corrugated sheet steel. The lining of the walls of the east half of battery consists of a 4-inch wall of hollow brick separated from the concrete wall by a layer of asbestos felt. The lining of the walls in the west half consists of galvanized corrugated sheet steel supported vertically on kyanized furring strips. The galvanized lining has been painted and covered with granulated cork.

The position-finder station was completed.

Two hundred and three shots were fired from this battery in 1901; nineteen were salvos of four shots each from one of the pits, and the remainder were single shots. The true level of the platforms was not disturbed by the firing, and the earth slopes stood well until saturated by rain, when some slipping took place. The doors into the magazines were found too weak to stand the blast and new steel doors of great strength will be built for one of the pits for test at this season's practice.

Money statements.

GUN AND MORTAR BATTERIES.

July 1, 1901, balance unexpended	$4,893.20
June 30, 1902, amount expended during fiscal year	4,666.14
July 1, 1902, balance unexpended and available	227.06

PRESERVATION AND REPAIR OF FORTIFICATIONS.

July 1, 1901, balance unexpended	$1,072.35
Allotted since	1,500.00
	2,572.35
June 30, 1902, amount expended during fiscal year	596.64
July 1, 1902, balance unexpended	1,975.71
July 1, 1902, outstanding liabilities	28.56
July 1, 1902, balance available	1,947.15

ALLOTMENTS.

Gun and mortar batteries.

July 3, 1896, act June 6, 1896	$100,000.00
December 14, 1896, act June 6, 1896	25,000.00
November 16, 1897, act June 6, 1896	10,000.00
February 9, 1898, act June 6, 1896	40,000.00
June 20, 1898, act May 7, 1898	17,000.00
December 27, 1898, act March 2, 1895	517.29
December 27, 1898, act June 6, 1896	1,336.36
December 27, 1898, act May 7, 1898	11,146.35
June 16, 1899, act March 3, 1899	1,050.00
May 4, 1900, act July 7, 1898	19,000.00
April 8, 1901, act May 25, 1900	5,000.00

Preservation and repair of fortifications.

August 23, 1899, act March 3, 1899	$1,400.00
April 4, 1901, act May 25, 1900	30.00
April 19, 1901, act March 1, 1901	1,000.00
May 10, 1901, act March 1, 1901	600.00
June 20, 1902, act June 6, 1902	1,500.00

Battery commander's station.—The station itself was completed, but means of communication with the mortar battery have yet to be provided.

Money statement.

July 1, 1901, balance unexpended	$2,405.38
June 30, 1902, amount expended during fiscal year	985.49
July 1, 1902, balance unexpended and available	1,419.89

ALLOTMENT.

September 26, 1900, act May 25, 1900	$4,600.00

SITE NO. 2.

Emplacements for five 10-inch B. L. rifles on disappearing carriages.—Laying of telephone wires and connecting emplacements with position-finder stations was in progress at beginning of and completed during the fiscal year.

These emplacements were among the first constructed to mount modern guns and were provided with crane hoists for raising ammunition. Plans have been prepared for installing chain hoists at two of the emplacements and plans for a like hoist for a third emplacement are in course of preparation.

Money statements.

GUN AND MORTAR BATTERIES.

July 1, 1901, balance unexpended	$603.97
June 30, 1902, amount expended during fiscal year	603.97

PRESERVATION AND REPAIR OF FORTIFICATIONS.

July 1, 1901, balance unexpended	$1,114.18
June 30, 1902, amount expended during fiscal year	114.18
July 1, 1902, balance unexpended and available	1,000.00

ALLOTMENTS.

Gun and mortar batteries.

November 5, 1892, act July 23, 1892	$110,000.00
September 27, 1894, act August 1, 1894	5,000.00
September 25, 1895, act March 2, 1895	5,000.00
July 3, 1896, act March 2, 1895, and June 6, 1896	65,000.00
September 16, 1896, act June 6, 1896	18,000.00
August 31, 1897, act June 6, 1896	21,000.00
June 14, 1900, act July 7, 1898	500.00
November 3, 1900, act July 7, 1898	700.00

Preservation and repair of fortifications.

August 18, 1899, act March 3, 1899	$12,000.00
September 21, 1900, act May 7, 1898	543.20
September 21, 1900, act March 3, 1899	456.80

Emplacements for two 12-inch B. L. rifles on disappearing carriages.—At the beginning of the fiscal year the plant required for the construction of the battery had been nearly all assembled. The excavation of earth had been about two-thirds and of rock one-half completed, and 670 cubic yards of concrete had been placed. The work of construction proceeded rapidly during the year, and at its end the following work had been done: Earth excavation, 1,557 cubic yards; rock excavation, 1,560 cubic yards; fill, 12,042 cubic yards; concrete, 9,387 cubic yards. To complete there will be required 1,750 cubic yards of fill and 90 cubic yards of concrete. The electric conduit and water pipe have been laid and the roadway in rear of the battery has been partly completed. At the end of the fiscal year the placing of fill, hanging of doors and windows, and other like work was in progress.

One of the post sewers crosses the site of the battery under emplacement No. 2. It was found to be crooked and in bad condition and was relaid with 8-inch glazed sewer pipe, laid in as nearly a straight line as possible, with manholes at either end and one in the guard room. Two hydrants have been placed, one in the center of each loading platform, which, with suitable length of hose attached, will supply water to all parts of the emplacements.

The prices paid for material were as follows: Portland cement, $1.66 to $1.75 per barrel; sand for concrete, $1.12 per cubic yard; crushed stone, $2.25 per cubic yard; sand fill, $1.07 per cubic yard; loam, $1.25 per cubic yard.

Money statement.

July 1, 1901, balance unexpended	$112,751.25
June 30, 1902, amount expended during fiscal year	90,352.08
July 1, 1902, balance unexpended	22,399.17
July 1, 1902, outstanding liabilities	3,671.34
July 1. 1902, balance available	18,727.83

ALLOTMENT.

November 9, 1900, act May 25, 1900	$130,000.00

Emplacements for three 6-inch B.L. rifles on pedestal mounts.—Negotiations have been in progress for the purchase of additional land to provide a suitable site for this battery and for position-finder stations.

Money statement.

July 1, 1901, balance unexpended	$30,000.00
Allotted since	16,500.00
	46,500.00
Withdrawn	12,500.00
July 1, 1902, balance unexpended and available	34,000.00

ALLOTMENTS.

November 9, 1900, act May 25, 1900	$30,000.00
December 31, 1901, act May 25, 1900	4,000.00

Fire commander's station.—This is designed after the type with a floor on two levels. The excavation has been completed and the walls constructed. The roof has not yet been placed. There remains to complete, the placing of drains and conduits, grading around building, building instrument base, constructing roof, putting in wooden floors, and placing doors and shutters.

Money statement.

Allotted November 19, 1901	$2,500.00
June 30, 1902, amount expended during fiscal year	435.89
July 1, 1902, balance unexpended	2,064.11
July 1, 1902, outstanding liabilities	657.45
July 1, 1902, balance available	1,406.66

ALLOTMENT.

November 19, 1901, act May 25, 1900	$2,500.00

Peace storage magazine.—The peace storage magazine has been erected under contract with F. W. Cunningham & Son, Portland, Me., dated October 18, 1901. It has been accepted and paid for, but not yet turned over to the artillery. With balance of funds on hand it is proposed to construct a fence, including two gates, around the building.

Money statement.

Allotted August 29, 1901	$5,000.00
June 30, 1902, amount expended during fiscal year	4,112.85
July 1, 1902, balance unexpended and available	887.15

ALLOTMENT.

August 29, 1901, act May 25, 1900 $5,000.00

Contract in force during fiscal year ending June 30, 1902.

Name of contractor: F. W. Cunningham & Son.
For magazine complete: Price, $3,895.
Date of contract: October 18, 1901.
Date of approval. (Emergency contract.)
Time for commencement: In 7 days.
Time for completion: In 60 days.
Contract completed.

Electric power house, installation, conduits, etc.—The power building is protected from direct and indirect fire by a ledge in its front. The outer walls are of rubble masonry and from 2 feet to 1½ feet in thickness. The roof has a solid layer of 3 feet of concrete to protect against fragments of rock and splinters. It was completed during the year. The machinery, which consists of one 90-horsepower Heine boiler, with a 75-horsepower Westinghouse, jr., engine and one Westinghouse 50-kilowatt direct-current generator, with switchboard and other auxiliaries, have been installed. The electric conduit, which is of the standard vitrified type, has been laid from the power house to and from the roadway in rear of the batteries and the cable has been drawn and connected up. The switchboards and storage batteries in the emplacements have not yet been set up. The poles for the post lighting system have been erected. The wire for post service will be strung as soon as it is received.

Money statement.

GUN AND MORTAR BATTERIES.

July 1, 1901, balance unexpended		$32,326.21
Allotted since		12,500.00
		44,826.21
June 30, 1902, amount expended during fiscal year		29,013.42
July 1, 1902, balance unexpended		15,812.79
July 1, 1902, outstanding liabilities	$8,838.62	
July 1, 1902, amount covered by uncompleted contracts	1,387.00	
		10,225.62
July 1, 1902, balance available		4,587.17

ALLOTMENTS.

January 3, 1901, act May 25, 1900	$34,500.00
January 27, 1902, act May 25, 1900	12,500.00

Contracts in force during fiscal year ending June 30, 1902.

Articles.	Name of contractor.	Date of contract.	Date of approval.	Time for completion.	Price.
Switchboards	H. B. Coho & Co	May 2, 1901	May 16, 1901	Aug. 19, 1901	$1,677.00
Accumulators	Sipe & Sigler	May 8, 1901	May 28, 1901	Oct. 10, 1901	3,700.00
Boiler	Heine Safety Boiler Co	July 31, 1901	Sept. 4, 1901	Nov. 8, 1901	1,350.00
Blower set	James Reilly Repair and Supply Co.	Aug. 9, 1901	Aug. 27, 1901	Oct. 15, 1901	162.50
Boiler feed pump	New Jersey Foundry and Machine Co.	Aug. 17, 1901	do.....	Sept. 28, 1901	73.00
Generating set	Westinghouse, Church, Kerr & Co.	Aug. 23, 1901	Sept. 12, 1901	Jan. 12, 1902	2,387.00
Miscellaneous apparatus.	The Burnet Co	Aug. 26, 1901	Sept. 26, 1901	Dec. 1, 1901	1,387.00
Wire	The Safety Insulated Wire and Cable Co.	Aug. 15, 1901	Oct. 25, 1901	Nov. 27, 1901	7,682.75

With exception of the Burnet Company, all the above have completed their contracts and have been partially paid.

Mining casemate.—Work was begun in July, 1901, and the casemate practically completed at the close of the fiscal year. The work done to June 30, 1902, comprises: Earth excavation, 215 cubic yards; ledge excavations, 598 cubic yards; concrete in building, 550 cubic yards. The walls of the building are screened by a rock bluff. Protection against indirect fire and splinters has been obtained by a roof of concrete 3 feet in thickness. A water pipe has been laid from the building to the post main, and a single duct of electric conduit has been laid to connect with the battery mains from the power house. The interior of the casemate is to have a lining of brick to prevent condensation. This has not yet been laid. The steel outer door and window shutters, and the stairway leading to the top of the bluff, have not yet been placed.

Money statement.

July 1, 1901, balance unexpended	$4,984.96
June 30, 1902, amount expended during fiscal year	2,721.81
July 1, 1902, balance unexpended	2,263.15
July 1, 1902, outstanding liabilities	215.27
July 1, 1902, balance available	2,047.88

ALLOTMENT.

October 20, 1900, act May 25, 1900	$5,000.00

SITE NO. 3.

Six emplacements for 8-inch B. L. rifles on disappearing carriages.—Two of these constitute one battery and three a second battery. Both batteries were completed and transferred to the artillery June 22, 1901. The magazines and shell rooms are protected against water leaking through the concrete overhead by damp-proof courses of asphalt. Other rooms do not have this protection and have been more or less leaky. An attempt has been made to reduce this leakage by covering the platforms with a mixture of two parts of neutral oil and one part of heavy oil. So far only a single coat has been applied, and the amount of water filtering into the rooms has been greatly reduced. A second coat will be applied as soon as the first coat has been absorbed, and if necessary a third application will be made.

The floors of the rooms were built level. They are to be covered by new floors, whose surface shall have as great a slope as possible, for drainage.

The sixth emplacement constitutes one of a battery containing three 8-inch and two 6-inch guns. At the beginning of the year the concrete had all been placed and the stone fill put in. During the year the loam has been placed, the roadway and rear slope partially graded, and the interior of rooms and passageways whitewashed. Originally the platform was made level and contained no damp-proof courses and was very leaky. This leakage has been entirely stopped by covering the old platform by a damp-proof course of asbestos felt paper and upon this constructing a thin paving of concrete, strengthened by twisted steel. The gun has been mounted. The lifts are of the balanced-platform type and are to be replaced by chain hoists.

Money statement.

July 1, 1901, balance unexpended	$3,020.15
June 30, 1902, amount expended during fiscal year	823.78
July 1, 1902, balance unexpended	2,196.37
July 1, 1902, outstanding liabilities	44.19
July 1, 1902, balance available	2,152.18

ALLOTMENTS.

"National Defense:"	
March 18,1898, act March 9, 1898	$150,000.00
August 16, 1898, act March 9, 1898	90,691.00
February 27, 1899, act March 9, 1898	4,309.00
March 16, 1899, act March 9, 1898	30,000.00
Gun and mortar batteries:	
June 29, 1899, act March 3, 1899	25,000.00
February 26, 1900, act July 7, 1898	17,000.00

Emplacements for two 8-inch B. L. rifles on disappearing carriages.—These are Nos. 1 and 3 of the same battery in which the sixth emplacement referred to in the preceding paragraph is No. 2. At the beginning of the year the concrete had all been placed and the fill nearly so. During the year the fill was completed, the roadway and slopes in rear of roadway partially graded, trolleys erected, interior of rooms whitewashed, and the plant and débris partially removed and guns mounted. The lifts are of the balanced-platform type and are to be replaced by chain hoists.

Money statement.

July 1, 1901, balance unexpended	$2,994.77
June 30, 1902, amount expended during fiscal year	1,716.31
July 1, 1902, balance unexpended	1,278.46
July 1, 1902, outstanding liabilities	129.39
July 1, 1902, balance available	1,149.07

ALLOTMENTS.

July 16, 1898, act May 7, 1898	$70,000.00
July 31, 1900, act May 7, 1898	12,000.00

Emplacements for two 12-inch B. L. rifles on disappearing carriages.—Battery was completed and transferred to the artillery under date of April 16, 1901. The rooms and magazines are protected, by damp-proof courses overhead, against water filtering into them through the concrete. The platforms are not so protected. A mixture of one part heavy oil and two parts neutral oil has been applied where desirable to render the concrete more impervious. The platform hoist of one of the emplacements is to be replaced by a chain hoist. The hoist has been ordered for early delivery and the work of preparing the emplacements has been commenced.

Money statement.

Allotted April 17, 1902	$2,500.00
June 30, 1902, amount expended during fiscal year	6.25
July 1, 1902, balance unexpended	2,493.75
July 1, 1902, outstanding liabilities	214.92
July 1, 1902, balance available	2,278.83

ALLOTMENTS.

March 16, 1897, act June 6, 1896	$200.00
March 27, 1897, act June 6, 1896	800.00
March 27, 1897, act March 3, 1897	70,000.00
August 13, 1897, act March 3, 1897	2,200.00
August 16, 1898, act March 3, 1897	36,800.00
October 30, 1899, act May 7, 1898	9,000.00
April 17, 1902, act March 1, 1901	2,500.00

Emplacements for eight 12-inch B. L. mortars.—The battery consists of two pits and three traverses. The overhead protection is obtained by concrete roof with a fill of sand on top. Before the sand fill was placed the concrete was covered by a layer of asphalt about 1 inch in thickness to insure dryness. At the beginning of the year the left and middle traverses had been practically completed, platforms laid, and the carriages amounted. During the year 1,486 cubic yards of concrete and 1,270 cubic yards of fill were placed, trolley rails hung, water-supply mains laid, the electric conduit constructed, and the roadway in rear of battery macadamized. The doors of the battery are of wood and have warped so badly as to suggest the substitution of steel doors. The battery is practically completed. Four of the mortars are mounted. The walls of the right traverse are lined with porous hollow tile.

Money statement.

July 1, 190I, balance unexpended	$19,761.58
June 30, 1902, amount expended during fiscal year	17,478.48
July 1, 1902, balance unexpended	2,283.10
July 1, 1902, outstanding liabilities	157.89
July 1, 1902, balance available	2,125.21

ALLOTMENTS.

July 30, 1898, act May 7, 1898	$116,000.00
January 14, 1901, act May 25, 1900	20,000.00
April 8, 1901, act May 25, 1900	1,000.00

Emplacements for two 6-inch rapid-fire guns on disappearing carriages.—These and three 8-inch gun emplacements constitute one battery. At the beginning of the year the concrete of one of the emplacements had been completed and the walls and parapet of the second one had been brought to roof level.

During the year 1,126 cubic yards of concrete, 4,664 cubic yards of sand, and 1,376 cubic yards of loam were placed; trolleys, doors, and windows hung; hoists erected; and the battery completed except the laying of the electric conduit and water-supply main, erection of hand rails, and grading and macadamizing roadway. Both guns are mounted.

The walls are lined with porous, hollow tile, plastered with a porous mortar. No condensation has ever been noticed except over a portion of one ceiling, where the plastering was given a smooth, impervious finish.

Money statement.

July 1, 1901, balance unexpended	$18,323.61
June 30, 1902, amount expended during fiscal year	16,333.50
July 1, 1902, balance unexpended	1,990.11
July 1, 1902, outstanding liabilities	732.49
July 1, 1902, balance available	1,257.62

ALLOTMENT.

March 17, 1899, act July 7, 1898	$56,000.00

Emplacements for two 3-inch rapid-fire guns (first battery).—At the beginning of the year the excavation had been completed, gun foundations built, and floors partly laid. During the year the battery was completed excepting the placing of a portion of the fill, erection of hand rails, macadamizing roadway, and construction of a metal stairway. The guns are the Driggs-Seabury 3-inch masked-parapet mounts, and are mounted. The rock excavation at this battery was 530 cubic yards; earth excavation, 196 cubic yards; concrete masonry, 812 cubic yards; fill (estimated), 2,700 cubic yards.

The walls are lined with porous, hollow tile, covered with a porous plastering, and have not shown any moisture of condensation.

Money statement.

July 1, 1901, balance unexpended	$8,429.49
June 30, 1902, amount expended during fiscal year	7,948.78
July 1, 1902, balance unexpended	480.71
July 1, 1902, outstanding liabilities	17.50
July 1, 1902, balance available	463.21

ALLOTMENT.

March 27, 1899, act July 7, 1898	$10,000.00

Emplacements for two 3-inch rapid-fire guns (second battery).—At the beginning of the year the excavation had been completed, and the plant and track had been made ready to mix and convey concrete. The battery was completed during the year except erection of hand rails and macadamization of roadway, and included rock excavation, 303 cubic yards; concrete masonry, 837 cubic yards; sand fill, 637 cubic yards. The guns and mounts have not been received.

The walls and ceilings are lined with porous, hollow tile, covered with a porous plastering, and have not shown any moisture of condensation.

Money statement.

July 1, 1901, balance unexpended	$8,047.11
June 30, 1902, amount expended during fiscal year	6,503.46
July 1, 1902, balance unexpended	1,543.65
July 1, 1902, outstanding liabilities	115.36
July 1, 1902, balance available	1,428.29

ALLOTMENTS.

November 9, 1900, act May 25, 1900	$3,625.00
May 1, 1901, act March 1, 1901	[a] 478.10

Emplacements for two 6-inch rapid-fire guns on pedestal mounts.—Work was commenced during the year. The excavation has all been made; plant erected; all floors, platform, and main drain laid; 760 cubic yards of concrete placed in floor walls, parapet, and gun block, and 320 linear feet of cable ducts laid.

The walls proper of the rooms are 6 inches in thickness and are

[a] To cover cost of triangulation of Portland Harbor.

made of a four-duct porous, hollow tile, 6 inches by 6 inches by 12 inches in length, smooth on side next the room. The ceilings proper are also made of hollow tile known as the "Herculean Arch," 8 inches in thickness. Both walls and ceilings are separated by an air space 4 inches wide from the main concrete walls and ceilings. This constitutes the main feature of the construction of this battery and is relied upon to secure almost entire freedom from condensation. Other features are the wide air space and surface drainage of rooms into air space and through air space to main drain under parapet and the use of concrete beams strengthened by twisted steel bars in place of iron beams.

Money statement.

July 1, 1901, balance unexpended	$25,000.00
Allotted since	3,900.00
	28,900.00
June 30, 1902, amount expended during fiscal year	16,470.40
July 1, 1902, balance unexpended	12,429.60
July 1, 1902, outstanding liabilities	2,430.39
July 1, 1902, balance available	9,999.21

ALLOTMENTS.

June 26, 1901, act March 1, 1901	$25,000.00
October 6, 1901, act May 25, 1900	3,900.00

Mining casemate No. 1.—About one-half the excavation had been completed at the beginning of the year. During the year the casemate was completed except the placing of the sand and loam fill and macadamizing area at entrance to casemate. Protection is given overhead and on three exposed sides. The unexposed side contains two windows for light and ventilation. The interior is lined with hollow brick to prevent condensation, and an air space 1½ feet wide separates the walls on the protected sides from the concrete masonry.

Money statement.

TORPEDOES FOR HARBOR DEFENSE.

July 1, 1901, balance unexpended	$5,392.93
June 30, 1902, amount expended during fiscal year	4,633,90
July 1, 1902, balance unexpended	759.03
July 1, 1902, outstanding liabilities	352.33
July 1, 1902, balance available	406.70

ALLOTMENT.

March 19, 1901, act March 1, 1901	$5,500.00

Mining casemate No. 2.—The excavation had been begun at the beginning of the year. The casemate was completed during the year except the erection of the hand rail. As in the case of the one on the first site, a lining of porous brick, wide air space, and windows in the wall on the side not exposed are the principal features of its construction.

Money statement.

TORPEDOES FOR HARBOR DEFENSE.

July 1, 1901, balance unexpended	$4,500.00
June 30, 1902, amount expended during fiscal year	4,105.91
July 1, 1902, balance unexpended	394.09
July 1, 1902, outstanding liabilities	19.30
July 1, 1902, balance available	374.79

ALLOTMENT.

June 15, 1901:	
Act March 3, 1899	$76.49
Act March 1, 1901	4,423.51

SITE NO. 4.

Emplacements for three 3-inch rapid-fire guns on balanced-pillar mounts.—During the year a wharf was built, water pipe to main site was laid, plant erected, excavation completed, main drains laid, material for concrete stored, and 360 yards of concrete placed. The foundation has been thoroughly drained, as an additional precaution against damp floors through absorption of moisture from underneath the floors, and walls proper rest upon a layer of tar paper which separates them from a subfoundation of concrete. A wide air space around the rooms, porous-tile lining of walls and ceilings, a system of surface drainage from rooms to air space, and from the floor of the latter to the main tile drain are the principal features of the construction of this battery.

Money statement.

Allotted July 3, 1901	$18,000.00
June 30, 1902, amount expended during fiscal year	7,465.74
July 1, 1902, balance unexpended	10,534.26
July 1, 1902, outstanding liabilities	1,058.78
July 1, 1902, balance available	9,475.48

ALLOTMENT.

July 3, 1901, act March 1, 1901	$18,000.00

Power house.—Work was commenced April 15, 1902. By the end of the fiscal year 1,077 cubic yards of earth and ledge had been removed, preparation of site completed, and laying of concerte foundation begun.

Money statement.

GUN AND MORTAR BATTERIES.

Allotted July 31, 1901	$6,600.00
Allotted August 26, 1901	1,500.00
	8,100.00
June 30, 1902, amount expended during fiscal year	2,876.05
July 1, 1902, balance unexpended	5,223.95
July 1, 1902, outstanding liabilities	621.50
July 1, 1902, balance available	4,602.45

ALLOTMEN

July 31, 1901, act March 1, 1901	$6,600.00
August 26, 1901, act May 7, 1898	1,500.00

Contract in force during fiscal year ending June 30, 1902.

For broken stone:
Name of contractor: Philip H. Doyen.
Date of contract: October 17, 1901.
Date of approval: (Emergency contract.)
Time of delivery: To begin ten days after award and continue as required.
Price: $1.45 per ton of 2,000 pounds.

SITE NO. 5.

Emplacements Nos. 2 and 3 for two 12-inch B. L. rifles on disappearing carriages.—At the beginning of the year emplacement No. 3 was complete and the gun was mounted. Emplacement No. 2 was nearly complete.

During the year 323 cubic yards of concrete and 2,062 cubic yards of sand fill were placed in No. 2, trolley rails and ammunition hoists were erected, and the gun was mounted. The permanent railroad and track is to be laid and a small amount of work is required on roadway and ventilators; otherwise these emplacements are complete. The drawings showing essential details of drains, ducts, etc., are in preparation with a view to the transfer of the battery to the artillery.

Money statement.

July 1, 1901, balance unexpended	$18,023.24
June 30, 1902, amount expended during fiscal year	13,715.57
July 1, 1902, balance unexpended	4,307.67
July 1, 1902, outstanding liabilities	256.58
July 1, 1902, balance available	4,051.09

ALLOTMENTS.

July 13, 1898, act May 7, 1898	$110,000.00
May 14, 1900, act July 7, 1898	17,000.00
February 13, 1901, act May 25, 1900	10,000.00

Emplacement No. 1 for 12-inch B. L. rifle on disappearing carriage.—At the beginning of the fiscal year the work on this emplacement was completed to the floor level. During the year 4,234 cubic yards of concrete masonry and 1,586 cubic yards of fill were placed and 561 square yards of asphalt waterproofing laid. A trench for drain to connect 12-inch and 10-inch gun batteries was excavated and an 8-inch vitrified tile laid; 400 feet of 2-inch galvanized-iron water pipe was laid in same trench. The trolley rails, ammunition hoists, etc., were set up and the gun was received. The emplacement is now complete, except receiving carriage and mounting the gun and minor work incidental to roadway, ventilators, etc.

Money statement.

July 1, 1901, balance unexpended	$37,556.35
June 30, 1902, amount expended during fiscal year	25,880.21
July 1, 1902, balance unexpended	11,676.14
July 1, 1902, outstanding liabilities	713.14
July 1, 1902, balance available	10,963.00

ALLOTMENTS.

May 23, 1899, act March 3, 1899	$52,000.00
February 13, 1901, act May 25, 1900	10,500.00

Emplacements for two 10-inch B. L. rifles on disappearing carriages.—At the beginning of the fiscal year all concrete work, except the wall of the right flank, was done; about three-fourths of the sand fill was placed, and the guns were mounted.

During the year 1,692 cubic yards of fill were placed, 100 cubic yards of concrete were laid in foundation of traverses adjacent to 6-inch battery, and guns were painted and cleaned.

These emplacements are now completed except as to finishing of roadway, and minor work required on ventilators, and calking of concrete joints.

Money statement.

July 1, 1901, balance unexpended	$7,318.55
Allotted since	1,000.00
	8,318.55
July 30, 1902, amount expended during fiscal year	4,805.94
July 1, 1902, balance unexpended	3,512.61
July 1, 1902, outstanding liabilities	302.47
July 1, 1902, balance available	3,210.14

ALLOTMENTS.

July 25, 1898, act July 7, 1898	$92,000.00
May 4, 1900, act July 7, 1898	26,000.00
June 23, 1902, act June 6, 1902	1,000.00

Emplacements for three 3-inch rapid-fire guns on pedestal mounts.—The battery was completed and guns were mounted at the beginning of the fiscal year. It is proposed to transfer them to the artillery as soon as the necessary drawings, which are being prepared, have been completed.

Money statement.

July 1, 1901, balance unexpended	$185.93
June 30, 1902, amount expended during fiscal year	81.78
July 1, 1902, balance unexpended	104.15
July 1, 1902, outstanding liabilities	22.64
July 1, 1902, balance available	81.51

ALLOTMENTS.

February 1, 1899, act July 7, 1898	$13,000.00
July 31, 1900, act July 7, 1898	2,000.00

Emplacements for four 6-inch rapid-fire guns on pedestal mounts.—Work was begun March 24, 1902. By the end of the fiscal year the derricks hadbeen erected; railway track extended; 621 cubic yards of earth and 772 cubic yards of rock excavated; 1,067 cubic yards of concrete masonry laid in foundation, floors, walls, and parapet; 90 feet of four-duct tile conduit laid, and 462 cubic yards of rock fill below roof level placed in the parapet. One-half of the battery is completed to the floor level; foundation for floors and walls of the other was laid, and about one-sixth of the bulk of the gun blocks and parapets of the whole battery are in place. In the matter of porous walls and ceilings for the rooms, surface drainage of floors into wide air space in front

of rooms, and the use of concrete instead of steel beams, this battery is similar in construction to the battery of two 6-inch guns on pedestal mounts, described under Site No. 3. It differs, however, from the latter in having the floors and walls proper of the rooms to rest upon a subfoundation of concrete and separated from it by a layer of tar paper laid in pitch to prevent damp floors by absorption of moisture from underneath.

Money statement.

Allotted February 3, 1902	$55,000.00
June 30, 1902, amount expended during fiscal year	11,125.42
July 1, 1902, balance unexpended	43,874.58
July 1, 1902, outstanding liabilities	5,629.68
July 1, 1902, balance available	38,244.90

ALLOTMENT.

February 3, 1902, act May 25, 1900	$55,000.00

Electric light and power plant.—Under a small allotment, about 400 feet of seven-tube conduit and four manholes were constructed along the line of the connecting drain between the 12-inch and 10-inch batteries.

Money statement.

GUN AND MORTAR BATTERIES.

Allotted October 17, 1901	$1,000.00
June 30, 1902, amount expended during fiscal year	937.26
July 1, 1902, balance unexpended	62.74
July 1, 1902, outstanding liabilities	22.62
July 1, 1902, balance available	40.12

ALLOTMENT.

October 17, 1901, act May 25, 1900	$1,000.00

RANGE-FINDING STATIONS.

Battery commanders' stations.—At the beginning of the year the excavation of all five sites had been made and construction commenced at two of them. All the buildings were completed and the grading around three of them was done during the fiscal year. The other two will be completed when the fill has been placed. All are built of concrete and brick, with glass and concrete roofs. The interiors are well lighted.

Money statement.

GUN AND MORTAR BATTERIES.

July 1, 1901, balance unexpended	$9,472.41
Withdrawn October 17, 1901	1,000.00
	8,472.41
June 30, 1902, amount expended during fiscal year	6,780.89
July 1, 1902, balance unexpended	1,691.52
July 1, 1902, outstanding liabilities	195.96
July 1, 1902, balance available	1,495.56

ALLOTMENTS.

April 8, 1899, act July 7, 1898	$9,000.00
December 20, 1900:	
Act July 7, 1898	1,500.24
Act May 25, 1900	1,499.76

Fire commander's station.—The building was commenced and constructed during the year. Except the grading, the station is completed. The design is of the latest type, with the floor on two levels, and with a bay on the observation side of the building. The roof is made of glass and concrete.

Money statement.

GUN AND MORTAR BATTERIES.

Allotted October 16, 1901	$2,700.00
June 30, 1902, amount expended during fiscal year	2,067.50
July 1, 1902, balance unexpended	632.50
July 1, 1902, outstanding liabilities	154.73
July 1, 1902, balance available	477.77

ALLOTMENT.

October 16, 1901, act May 25, 1900	$2,700.00

Temporary stations for range and position finders.—The necessary work for two temporary stations for use in mortar practice was completed.

Money statement.

GUN AND MORTAR BATTERIES.

July 1, 1901, balance unexpended	$100.00
June 30, 1902, amount expended during fiscal year	100.00

TORPEDO DEFENSE.

Torpedo material.—The torpedo material for the district, in charge of the Engineer Department, has been cared for and, as needed, overhauled and cleaned, under allotments from appropriation for "Preservation and Repair of Fortifications." The material pertaining to Portland Harbor was transferred to the artillery under date of September 30, 1901.

Money statement.

July 1, 1901, balance unexpended	$94.02
June 30, 1902, amount expended during fiscal year	87.19
July 1, 1902, balance unexpended and available	6.83

SUPPLIES FOR SEACOAST DEFENSES.

Under funds allotted for the purpose small quantities of supplies have from time to time been furnished post commanders on requisitions approved by the Chief of Engineers.

Money statement.

July 1, 1901, balance unexpended	$569.32
June 30, 1902, amount expended during fiscal year	131.78
July 1, 1902, balance unexpended	437.54
July 1, 1902, outstanding liabilities	10.93
July 1, 1902, balance available	426.61

CIVILIAN ELECTRICIANS.

An allotment of $1,200 was made June 27, 1902, from appropriation, "Preservation and Repair of Fortifications," for pay of one expert electrician for one year, said electrician to report to commanding officer of the artillery district of Portland, Me., for duty.

Money statement.

Allotted June 27, 1902	$1,200.00
July 1, 1902, balance unexpended	1,200.00

General contracts in force during fiscal year ending June 30, 1902.

For Portland cement:
Name of contractor: James A. Davis & Co.
Date of contract: July 15, 1901.
Date of approval: (Emergency contract.)
Time for delivery: Working season of 1901. Completed.
Price: $1.55 per barrel.

For Portland cement:
Name of contractor: Waldo Bros.
Date of contract: March 5, 1902.
Date of approval: (Emergency contract.)
Time for delivery: As required during present working season.
Price: $1.49 per barrel.

For bituminous coal:
Name of contractor: Randall & McAllister.
Date of contract: February 12, 1902.
Date of approval: Emergency contract.
Time for delivery: As required during present working season.
Price: $4.50 per ton.

For coal and water:
Name of contractor: A. R. Wright Co.
Date of contract: February 15, 1902.
Date of approval: (Emergency contract.)
Time for delivery: As required during present working season.
Prices: $4.70 per ton for bituminous coal, $5.40 per ton for anthracite, and 40 cents per 1,000 gallons for fresh water.

For sand:
Name of contractor: Rowe Bros. Co.
Date of contract: March 27, 1902.
Date of approval: Emergency contract.
Time for delivery: As required during present working season.
Price: 65 cents per ton.

2 B.

DEFENSES OF PORTSMOUTH, NEW HAMPSHIRE.

Officer in charge, Capt. Harry Taylor, Corps of Engineers; assistant, Lieut. Robert R. Raymond, Corps of Engineers, until November 2, 1901; Division Engineer, Col. Charles R. Suter, Corps of Engineers.

Emplacements for two 12-inch guns on disappearing carriages.—At the beginning of the fiscal year plans and estimates for the battery had been prepared and submitted, and an artesian well had been drilled to a depth of 185 feet. During the year the plant which had been used in the construction of other emplacements in the harbor was transferred to the site of this work, installed, and put in operation. The artesian well proved a failure on account of striking seams in the rock through which it was drilled which connected with the salt water. The well was abandoned and a pipe laid to a connection with the mains of the Portsmouth Water Company. The excavation for the battery was completed, the foundations of the wall put in, and the floors of the rooms in one-half of the battery nearly completed. The frames for the concrete forms were practically all completed ready for erection.

Money statement.

July 1, 1901, balance unexpended		$2,000.00
Allotted since		113,000.00
		115,000.00
Withdrawn		8,000.00
		107,000.00
June 30, 1902, amount expended during fiscal year		36,681.69
July 1, 1902, balance unexpended		70,318.31
July 1, 1902, outstanding liabilities	$4,746.88	
July 1, 1902, amount covered by uncompleted contracts	20,205.44	
		24,952.32
July 1, 1902, balance available		45,365.99

Emplacements for three 10-inch guns on disappearing carriages.—At the beginning of the fiscal year the construction of these emplacements was practically completed, with the exception of seeding the slopes and clearing up the ground in the vicinity of the emplacements. During the year the emplacements were completed, the wooden doors were replaced by steel doors, the plant used in the construction of the emplacements was taken down and removed, and the vicinity of the battery cleaned up. The electric-light plant has not been installed. All three carriages and two of the guns were mounted.

The battery was transferred to the artillery December 16, 1901.

Money statement.

July 1, 1901, balance unexpended	$6,364.67
June 30, 1902, amount expended during fiscal year	6,364.67

Emplacements for two 8-inch guns on disappearing carriages.—This battery, which was built under contract, was completed, with the exception of the electric-light plant, and turned over to the artillery July 23, 1898. During the past fiscal year the floors in the magazines of the shell rooms and adjacent passages were torn up and relaid on a layer of broken stone. The drains were relaid and given greater slopes than were previously provided. The exterior surfaces of the concrete were coated with hot linseed oil and painted a dead grass-green. The work which was done during the fiscal year materially improved the condition of the emplacements in regard to dampness.

Money statement.

July 1, 1901, balance unexpended	$4,087.20
June 30, 1902, amount expended during fiscal year	4,087.20

Torpedo storehouse.—At the beginning of the fiscal year the building, which is of brick, 72 by 32 feet, with slate roof, was completed, with the exception of a few minor details and the installation of a traveling crane for handling the torpedo material. The building was entirely completed during the fiscal year and the crane installed.

The building, together with all property pertaining to the submarine-mine defense of the harbor, was turned over to the artillery December 16, 1901.

Money statement.

TORPEDOES FOR HARBOR DEFENSE.

July 1, 1901, balance unexpended	$5,690.00
June 30, 1902, amount expended during fiscal year	5,690.00

Cable tank.—At the beginning of the fiscal year the tank was practically completed. During the year a pump was installed in the torpedo storehouse, to be operated by an oil engine belonging to the torpedo defense, for the purpose of pumping water from the cistern built underneath the torpedo storehouse into the cable tank. The cable, which had heretofore been stored at Portland Harbor, Maine, was placed in the cable tank.

The tank was turned over to the artillery December 16, 1901.

Money statement.

TORPEDOES FOR HARBOR DEFENSE.

July 1, 1901, balance unexpended	$605.37
June 30, 1902, amount expended during fiscal year	605.37

Preservation and repair of fortifications.—With funds allotted from this appropriation surplus and unserviceable submarine-mining material was prepared for shipment to the Engineer Depot, and various minor repairs were made to buildings and batteries at the various forts.

Money statements.

Allotted November 8, 1901	$420.70
Withdrawn	100.00
	320.70
June 30, 1902, amount expended during fiscal year	320.70

FORT M'CLARY, ME.

July 1, 1901, balance unexpended	$336.25
Withdrawn	97.67
	238.58
June 30, 1902, amount expended during fiscal year	238.58

FORT CONSTITUTION, N. H.

July 1, 1901, balance unexpended	$426.95
Withdrawn	420.70
	6.25
June 30, 1902, amount expended during fiscal year	6.25

Contracts in force during fiscal year ending June 30, 1902.

Tile of modified book-tile pattern:
Contractor: National Fireproofing Company, Pittsburg, Pa.
Date of contract: February 20, 1902.
Date of commencement: Within 10 days from date of signing contract.
Date of completion: Within 80 days of commencement.
Price: $157.50 per 1,000 for style A, and $210 per 1,000 for style B.

Steel doors:
Contractor: G. P. Bullard & Co., Boston, Mass.
Date of contract: April 17, 1902.
Date of commencement: Immediately after signing contract.
Date of completion: Within 90 days of commencement.
Price: Single leaf, 2 feet 6 inches, $27; single leaf, 3 feet, $30; single leaf, 4 feet, $40; double leaf, 6 feet, $54.

Saylor's Portland cement:
Contractor: Berry & Ferguson, Boston, Mass.
Date of contract: May 9, 1902.
Date of approval: May 22, 1902.
Date of commencement: Within 10 days after date of notification of approval of contract.
Date of completion: On or before December 1, 1902.
Price: $1.40 per barrel, in sacks.

Broken stone:
Contractors: Rockport Granite Company and Pigeon Hill Granite Company, Rockport, Mass.
Date of contract: May 14, 1902.
Date of approval: May 31, 1902.
Date of commencement: Within 10 days after notification of approval of contract.
Date of completion: On or before December 1, 1902.
Price: $1.85 per cubic yard.

Sand:
Contractor: Rowe Brothers Company, Richmond, Me.
Date of contract: May 16, 1902.
Date of approval: June 11, 1902.
Date of commencement: Within 10 days after date of notification of approval of contract.
Date of completion: On or before December 1, 1902.
Price: 67 cents per cubic yard.

2 C.

DEFENSES OF BOSTON HARBOR, MASSACHUSETTS.

Officer in charge, Capt. Harry Taylor, Corps of Engineers; assistant, Lieut. Robert R. Raymond, Corps of Engineers, until November 2,1901; Division Engineer, Col. Charles R. Suter, Corps of Engineers.

SITE NO. 1.

Emplacements for two 12-inch guns on disappearing carriages.—At the beginning of the fiscal year these emplacements were completed with the exception of part of the earth fill in the parapet and grading and seeding the slopes. No work was done on the parapet during the fiscal year, as the earth was still settling. At the end of the fiscal year the settling appears to have stopped, and the parapet will be completed as soon as funds are available for the purpose. During the fiscal year the rooms in the old fort, which are to be used in connection with these emplacements, were cleared of all old material and engineer property which had been stored in them, with the exception of one room in which there remains a lot of condemned iron, which is to be

sold. The walks in the vicinity of the emplacements were repaired, and the rubbish which was left when the concrete work was completed was cleared up. Under a special allotment temporary connections were made to the electric motors for maneuvering the carriages. The armament is mounted and in the hands of the artillery.

Money statements.

TWO 12-INCH GUN EMPLACEMENTS.

July 1, 1901, balance unexpended	$37.10
Allotted since	335.00
	372.10
Withdrawn	19.65
June 30, 1902, amount expended during fiscal year	352.45

MOUNTING TWO 12-INCH GUNS.

July 1, 1901, balance unexpended	$42.48
October 29, 1901, withdrawn	42.48
January 30, 1902, allotted	42.48
June 30, 1902, amount expended during fiscal year	42.48

TEMPORARY ELECTRICAL CONNECTIONS FOR MANEUVERING 12-INCH GUN CARRIAGES.

February 13, 1902, amount allotted	$100.00
June 30, 1902, amount expended during fiscal year	100.00

Emplacements for four 10-inch guns on disappearing carriages.—At the beginning of the fiscal year this battery had been completed, armament mounted, and electric plant installed. During the fiscal year a roadway was built in the rear of the battery and general repairs made. Under a special allotment one pair of the old-type balanced-platform lifts was removed from the battery and a new type chain hoist purchased and installed.

Money statements.

EMPLACEMENTS, ETC.

August 12, 1901, amount allotted	$540.00
June 30, 1902, amount expended during fiscal year	540.00

AMMUNITION HOIST.

February 25, 1902, amount allotted		$1,500.00
June 30, 1902, amount expended during fiscal year		102.46
July 1, 1902, balance unexpended		1,397.54
July 1, 1902, outstanding liabilities	$57.40	
July 1, 1902, amount covered by uncompleted contracts	1,188.00	
		1,245.40
July 1, 1902, balance available		152.14

SITE NO. 2.

Emplacements for five 10-inch guns on disappearing carriages.—At the beginning of the fiscal year the emplacements were practically completed with the exception of the road in rear of the battery. During the fiscal year a road was begun and nearly completed from the wharf to the vicinity of the emplacements and along the rear of

all the emplacements. At the time the emplacements were built a light-house stood immediately in rear of them. This light-house has since been moved to another site. During the year the old site of the light-house was cleared up. Under a special allotment one pair of old-type balanced-platform lifts was removed and a chain hoist of new type partly installed. Owing to the failure of the contractors for the chain hoist to deliver it on time it was only partially installed at the end of the fiscal year.

Money statements.

EMPLACEMENTS, ETC.

July 1, 1901, balance unexpended	$10,803.67
June 30, 1902, amount expended during fiscal year	10,803.67

AMMUNITION HOIST.

February 25, 1902, amount allotted		$1,425.00
June 30, 1902, amount expended during fiscal year		89.58
July 1, 1902, balance unexpended		1,335.42
July 1, 1902, outstanding liabilities	$26.64	
July 1, 1902, amount covered by uncompleted contracts	1,188.00	
		1,214.64
July 1, 1902, balance available		120.78

SITE NO. 3.

Emplacements for three 12-inch guns on disappearing carriages.—This battery was practically completed at the beginning of the fiscal year. The armament and electric plant were installed. It was transferred to the artillery October 4, 1901. During the past fiscal year minor repairs to the battery have been made under allotments for preservation and repair of fortifications. The repairs consisted in placing concrete pillars in the observation stations for mounting of type B range finders, putting the doors and windows in good order, overhauling the locks, repairing the trolleys, stopping leaks in the roof of the fire-commander's station, and other minor miscellaneous repairs.

Money statement.

PRESERVATION AND REPAIR OF FORTIFICATIONS.

July 1, 1901, balance unexpended		$522.78
Allotted since		527.84
		1,050.62
Withdrawn	$0.18	
June 30, 1902, amount expended during fiscal year	946.53	
		946.71
July 1, 1902, balance unexpended		103.91
July 1, 1902, outstanding liabilities		2.40
July 1, 1902, balance available		101.51

SITE NO. 4.

Mortar battery for sixteen 12-inch B. L. rifled steel mortars on model 1891 carriages.—At the beginning of the year the battery had been completed and was in the hands of the artillery. Owing to insufficient

drainage the battery was at times flooded with rain water, and, caused by the action of the frost, the walls in some of the pits were scaling badly. During the fiscal year a complete system of drains was finished and new floors were laid throughout all of the magazines and passages and in all of the pits except a small portion of the rear of two of the pits. The wall of one pit was repaired.

Money statements.

GUN AND MORTAR BATTERIES.

July 1, 1901, balance unexpended	$5,667.06
June 30, 1902, amount expended during fiscal year	5,667.06

PRESERVATION AND REPAIR OF FORTIFICATIONS.

July 1, 1901, balance unexpended		$2,335.13
Withdrawn	$0.13	
June 30, 1902, amount expended during fiscal year	2,052.29	
		2,052.42
July 1, 1902, balance unexpended		282.71
July 1, 1902, outstanding liabilities		273.61
July 1, 1902, balance available		9.10

SITE NO. 5.

Emplacements for two 6-inch rapid-fire guns on pedestal mounts.—At the beginning of the fiscal year plans had been prepared and approved. Nothing had been done toward construction. During the fiscal year the excavation for the battery was completed and the drainage system laid. Work on this battery was delayed, as the site of the battery was occupied by a supply of crushed stone intended for use in a mortar battery being constructed at the same post. On account of delays in the construction of the mortar battery, due to discovery of quicksand under the foundations, the crushed stone was not removed from the site of the 6-inch battery until late in the season of 1901. As soon as the excavation was completed work was closed down for the winter on account of cold weather.

Money statement.

July 1, 1901, balance unexpended	$27,000.00
June 30, 1902, amount expended during fiscal year	9,169.52
July 1, 1902, balance unexpended	17,830.48
July 1, 1902, outstanding liabilities	148.03
July 1, 1902, balance available	17,682.45

Mortar battery for sixteen 12-inch B. L. rifled steel mortars on model 1896 carriages.—One half of this battery had been completed under contract prior to the beginning of the fiscal year and the other half of the battery was under construction by hired labor. At the beginning of the year the working plant and quarters for the working force had been installed, materials of construction purchased, the excavation completed, drains laid, about one-half of the foundations placed, and

the construction of forms begun. Work on this battery was greatly delayed by the discovery of quicksand underneath the foundations of part of the masonry. An extensive drainage system was put in and the quicksand drained. During the fiscal year all of the concrete work of the battery except the floors and platforms was completed. The surface of the concrete was waterproofed throughout and part of the back fill around the concrete made. The excavation in the mortar pits yet remains to be done. This material, as it is excavated, will be placed over the concrete, forming the parapet. Funds for the completion of the work were allotted during the year. The remainder of the excavation is being completed under contract.

Money statement.

July 1, 1901, balance unexpended		$58,106.57
Allotted since		36,720.41
		94,826.98
June 30, 1902, amount expended during fiscal year		57,664.78
July 1, 1902, balance unexpended		37,162.20
July 1, 1902, outstanding liabilities	$1,908.86	
July 1, 1902, amount covered by uncompleted contracts	15,823.50	
		17,732.36
July 1, 1902, balance available		19,429.84

SITE NO. 6.

Construction of storehouses.—On January 2, 1901, the Secretary of War set aside a portion of the military reservation to be used for the storage and care of engineer property not in use in construction work. An allotment of $3,500 was made by the Chief of Engineers on January 5, 1901, for the construction of two storehouses upon this reservation. At the beginning of the fiscal year one large storehouse had been nearly completed. During the fiscal year both storehouses were completed. The smaller storehouse is in temporary use as quarters for the assistant engineer in local charge of the construction. It will be available for use as a storehouse whenever needed.

Money statement.

GUN AND MORTAR BATTERIES.

July 1, 1901, balance unexpended	$731.98
June 30, 1902, amount expended during fiscal year	731.98

Emplacements for four 10-inch guns on disappearing carriages.—At the beginning of the fiscal year plans had been prepared, plant purchased and partly installed, and the excavation had been begun. During the fiscal year the excavation for the platforms for three of the guns, with their magazines, shell rooms, etc., has been completed. The drains and electric conduits and speaking tubes have been placed as far as practicable. Form lumber and ironwork for three of the emplacements are on hand. The allotments made prior to the end of the fiscal year are for the construction of three emplacements only, and the work has been confined to those three emplacements.

Money statement.

July 1, 1901, balance unexpended		$188,966.50
June 30, 1902, amount expended during fiscal year		44,985.90
July 1, 1902, balance unexpended		143,980.60
July 1, 1902, outstanding liabilities	$3,970.60	
July 1, 1902, amount covered by uncompleted contracts	31,483.00	
		35,453.60
July 1, 1902, balance available		108,527.00

Emplacements for two 6-inch rapid-fire guns on pedestal mounts.—At the beginning of the year plans had been prepared and approved, preparations for the work made, and the forms partly erected. During the fiscal year the battery was completed with the exception of laying the floors, hanging the doors, the installation of the ammunition hoists, and the final grading and sodding of the parapet, which can not be done until settlement ceases.

Money statement.

July 1, 1901, balance unexpended		$25,000.00
Allotted since		7,000.00
		32,000.00
Withdrawn	$10,100.00	
June 30, 1902, amount expended during fiscal year	18,655.23	
		28,755.23
July 1, 1902, balance unexpended and available		3,244.77

Emplacements for three 6-inch guns on disappearing carriages.—At the beginning of the fiscal year these emplacements were nearly completed except the parados. During the fiscal year the parados was completed excepting the final grading and sodding. This was left until settlement ceased. The carriages are mounted and cared for by the Engineer Department. Guns had not been received at the end of the fiscal year.

Money statements.

GUN AND MORTAR BATTERIES.

July 1, 1901, balance unexpended		$8,186.06
Allotted since		1,500.00
		9,686.06
Withdrawn	$4,900.00	
June 30, 1902, amount expended during fiscal year	3,320.01	
		8,220.01
July 1, 1902, balance unexpended and available		1,466.05

PRESERVATION AND REPAIR OF FORTIFICATIONS.

July 1, 1901, balance unexpended		$189.11
Withdrawn	$43.11	
June 30, 1902, amount expended during fiscal year	146.00	
		189.11

Emplacements for four 3-inch rapid-fire guns on pedestal mounts.—At the beginning of the fiscal year a railroad for carrying the materials of construction had been laid from the wharf to the site of the work, a derrick and engine installed, the excavation completed, drains laid, forms erected, and the concrete work commenced. During

the fiscal year the battery was completed, with the exception of the floors in the magazines and shell rooms, hanging the doors, and the final grading and sodding of the parapet, which can not be done until settlement ceases.

Money statement.

July 1, 1901, balance unexpended		$17,409.81
Withdrawn	$5,000.00	
June 30, 1902, amount expended during fiscal year	11,044.03	
		16,044.03
July 1, 1902, balance unexpended and available		1,365.78

Emplacement for one 3-inch rapid-fire gun on pedestal mount.—At the beginning of the year the concrete work was completed. Fill and grading had not been commenced. During the year the parapet was completed, except the final grading and sodding, which can not be done until settlement ceases.

Money statement.

July 1, 1901, balance unexpended		$6,173.17
Withdrawn	$3,500.00	
June 30, 1902, amount expended during fiscal year	1,951.58	
		5,451.58
July 1, 1902, balance unexpended and available		721.59

CONSTRUCTION OF LIGHTER.

Authority for the construction or purchase of a steam lighter for use in connection with the fortification work in Boston Harbor was given by the Chief of Engineers May 15, 1901. At the beginning of the year plans and specifications were being prepared. During the fiscal year the lighter was completed and delivered. It has been in use since December, 1901, and has proved of great value in facilitating the fortification work in the harbor.

Money statement.

GUN AND MORTAR BATTERIES.

July 1, 1901, balance unexpended	$20,000.00
June 30, 1902, amount expended during fiscal year	20,000.00

TORPEDOES FOR HARBOR DEFENSE.

Under an allotment from the appropriation for "Torpedoes for Harbor Defense" the construction of a cable tank and an extension to the same were authorized. At the beginning of the fiscal year the tank as originally planned had been completed, the extension to the tank partially finished, and a frame shed partially constructed over the tank. During the fiscal year the cover for the tank was completed and trolleys for handling the cable were purchased and installed.

Money statement.

July 1, 1901, balance unexpended	$3,385.00
June 30, 1902, amount expended during fiscal year	2,467.44
July 1, 1902, balance unexpended	917.56
July 1, 1902, outstanding liabilities	101.55
July 1, 1902, balance available	816.01

Submarine-mining material.—At the beginning of the fiscal year the bulk of the material for the submarine-mine defense was stored in one of the old-type works. Part of it, consisting of anchors, junction boxes, rope, etc., was stored on the wharf used by the Engineer Department in the city of Boston. During the fiscal year this was transferred to the old fort, where the remainder of the material was stored, and put away with the other material of the same classes.

Money statements.

PRESERVATION AND REPAIR OF FORTIFICATIONS.

July 1, 1901, balance unexpended		$273.56
Withdrawn	$47.99	
June 30, 1902, amount expended during fiscal year	225.57	
		273.56

TORPEDOES FOR HARBOR DEFENSE.

May 12, 1902, amount allotted	$100.00
June 30, 1902, amount expended during fiscal year	100.00

Sites for fortifications and seacoast defenses.—During the fiscal year negotiations were in progress for the acquisition of a tract for additional batteries. Part of the tract was purchased; the balance could not be purchased at what was considered reasonable prices, and on December 20, 1901, the Secretary of War authorized the acquisition by condemnation of all parts of the desired tract which had not been acquired by purchase. At the end of the fiscal year the condemnation proceedings were in progress.

Money statement.

July 1, 1901, balance unexpended	$136,886.38
June 30, 1902, amount expended during fiscal year	65,046.44
July 1, 1902, balance unexpended and available	71,839.94

SUPPLIES FOR SEACOAST DEFENSES.

Under the provisions of General Orders, No. 66, Headquarters of the Army, Adjutant-General's Office, 1900, electrical supplies were purchased upon such requisitions by the post commanders as were approved by the Chief of Engineers.

Money statement.

July 1, 1901, balance unexpended		$380.71
Allotted since		1,300.00
		1,680.71
June 30, 1902, amount expended during fiscal year		1,055.36
July 1, 1902, balance unexpended		625.35
July 1, 1902, outstanding liabilities		38.50
July 1, 1902, balance available		586.85

PRESERVATION AND REPAIR OF FORTIFICATIONS.

With funds from this appropriation various minor repairs were made to buildings and batteries at the various forts from time to time during the year.

Money statements.

OLD FORT.

July 1, 1901, balance unexpended		$64.87
Withdrawn	$9.87	
June 30, 1902, amount expended during fiscal year	55.00	
		64.87

SITE NO. 2.

July 1, 1901, balance unexpended		$540.03
Withdrawn	$0.03	
June 30, 1902, amount expended during fiscal year	157.06	
		157.09
July 1, 1902, balance unexpended		382.94
July 1, 1902, outstanding liabilities		4.00
July 1, 1902, balance available		378.94

SITE NO. 1.

July 1, 1901, balance unexpended	$311.44	
Allotted since	200.00	
		$511.44
Withdrawn	44.04	
June 30, 1902, amount expended during fiscal year	467.40	
		511.44

SITE NO. 4.

July 1, 1901, balance unexpended		$438.75
Withdrawn	$238.94	
June 30, 1902, amount expended during fiscal year	199.81	
		438.75

SITE NO. 5.

July 1, 1901, balance unexpended		$474.15
Withdrawn	$385.20	
June 30, 1902, amount expended during fiscal year	88.95	
		474.15

Contracts in force during fiscal year ending June 30, 1902.

Broken stone:
Name of contractor: Pigeon Hill Granite Company, Rockport, Mass.
Date of contract: August 9, 1901.
Date of commencement: Immediately after date of signature of contract.
Date of completion: Within 3 months from date of commencement.
Price: $1.57 per cubic yard.

Broken stone:
Name of contractors: Rockport Granite Company and Pigeon Hill Granite Company, Rockport, Mass.
Date of contract: May 14, 1902.
Date of approval: May 31, 1902.
Date of commencement: Within 10 days after date of notification of approval of contract.
Date of completion: On or before December 1, 1902.
Price: $1.75 per cubic yard.

Broken stone:
Name of contractors: Rockport Granite Company and Pigeon Hill Granite Company, Rockport, Mass.
Date of contract: June 7, 1902.
Date of commencement: Within 10 days after date of signature of contract.
Date of completion: On or before August 31, 1902.
Price: $1.75 per cubic yard.

Steam lighter:
Name of contractor: Arthur D. Story, Essex, Mass.
Date of contract: August 9, 1901.
Date of approval: August 19, 1901.
Date of commencement: On date of notification of approval of contract.
Date of completion: 120 days from date of commencement.
Price: $19,450.

Four 6-inch ammunition lifts:
Name of contractor: Ellicott Machine Company, Baltimore, Md.
Date of contract: August 19, 1901.
Date of commencement: Within 5 days after date of signature of contract.
Date of completion: Within 60 days from date of commencement.
Price: $1,638.

Constructing earth embankment:
Name of contractor: John Cashman, Quincy, Mass.
Date of contract: November 8, 1901.
Date of commencement: Within 10 days after date of signature of contract.
Date of completion: Within 90 days from date of commencement.
Price: 60 cents per cubic yard.

Tile of modified book-tile pattern:
Name of contractor: National Fireproofing Company, Pittsburg, Pa.
Date of contract: February 20, 1902.
Date of commencement: 10 days from date of signature of contract.
Date of completion: Within 90 days of commencement.
Price: $157.50 per 1,000, style A, and $210 per 1,000, style B.

Two 10-inch ammunition hoists, with motors complete:
Name of contractor: Ellicott Machine Company, Baltimore, Md.
Date of contract: March 25, 1902.
Date of commencement: Immediately after date of signature of contract
Date of completion: Within 60 days from date of commencement.
Price: $2,376.

Excavating and ditching:
Name of contractor: George H. Keyes, Charlestown, Mass.
Date of contract: April 17, 1902.
Date of commencement: Immediately after date of signature of contract.
Date of completion: Within 60 days from date of commencement.
Price: 55 cents per cubic yard for excavating, and 85 cents per cubic yard for ditching.

Steel doors:
Name of contractor: G. P. Bullard & Co., Boston, Mass.
Date of contract: April 17, 1902.
Date of commencement: Immediately after date of signature of contract.
Date of completion: Within 90 days from date of commencement.
Price: Single leaf, 2 feet 6 inches, $27; single leaf, 3 feet, $30; single leaf, 4 feet, $40; double leaf, 4 feet, $47; double leaf, 6 feet, $54; double leaf, 10 feet, $86.

Furnishing board to United States employees:
Name of contractor: Margaret Riley, Rutland, Mass.
Date of contract: April 28, 1902.
Date of approval: May 6, 1902.
Date of commencement: Immediately after date of notification of approval of contract.
Date of completion: On or before December 15, 1902.
Price: 16½ cents per meal.

Saylor's Portland cement:
Name of contractor: Berry & Ferguson, Boston, Mass.
Date of contract: May 9, 1902.
Date of approval: May 22, 1902.
Date of commencement: Within 10 days after date of notification of approval of contract.
Date of completion: On or before December 1, 1902.
Price: $1.40 per barrel, in sacks.

Sand:
Name of contractor: Rowe Brothers Company, Richmond, Me.
Date of contract: May 16, 1902.
Date of approval: June 11, 1902.
Date of commencement: Within 10 days after date of notification of approval of contract.
Date of completion: On or before December 1, 1902.
Price: 67 cents per cubic yard.

Sand:
Name of contractor: Rowe Brothers Company, Richmond, Me.
Date of contract: May 16, 1902.
Date of commencement: Within 10 days after date of signature of contract.
Date of completion: On or before August 31, 1902.
Price: 70 cents per cubic yard.

Excavating, sodding, etc.:
Name of contractor: George H. Keyes, Charlestown, Mass.
Date of contract: May 29, 1902.
Date of approval: June 11, 1902.
Date of commencement: Within 10 days after date of signature of contract.
Date of completion: Within 75 days from date of commencement.
Price: Excavation, 75 cents per cubic yard; sodding, 75 cents per square yard; seeding, 2½ cents per square yard; sand and gravel for masonry cover and blind drains, $1.75 per cubic yard; placing the following material furnished by the United States: Vitrified sewer pipe, 5 cents per linear foot; tile drain pipe, 5 cents per linear foot; inlets, $2 per foot; manholes, $3 per foot; galvanized-iron pipe, 2 cents per foot; hydrants, $1 each; street washers and service boxes, 25 cents each.

ROADWAY AT WINTHROP, MASS.

[Printed in House Doc. No. 580, Fifty-seventh Congress, first session.]

WAR DEPARTMENT,
Washington, April 26, 1902.

SIR: I have the honor to transmit herewith, together with other papers, a letter from the Chief of Engineers, U. S. Army, dated April 16 instant, recommending, for reasons stated, the relinquishment and dedication to the town of Winthrop, Suffolk County, Mass., of a strip of land, as described in said letter, for the purposes of a public highway, and that the sum of $200 be appropriated for the purpose of grading and making a roadway through the middle of said strip of land.

A draft of a bill to carry the above-indicated recommendations into effect is submitted herewith, and it is recommended that the same be enacted into law.

Very respectfully,

WM. CARY SANGER,
Acting Secretary of War.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

OFFICE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, April 16, 1902.

SIR: In 1891 and 1892 a tract of land at Winthrop, Suffolk County, Mass. (then referred to as Grovers Cliff), comprising numerous parcels owned by different persons, was purchased by authority of the Secretary of War as a site for fortifications. This land is now the site of Fort Banks.

A private way, known as "Elm avenue," passed through and formed a part of the tract so acquired. The closing of this avenue was necessary in connection with the construction and maintenance of the works of fortification on the site. The Secretary of War, on October 22, 1891, authorized Col. S. M. Mansfield, Corps of Engineers, then in charge of defensive works at that locality, to accept, in behalf of the United States, the donation of private right, title, and interest in the

portion of Elm avenue within the limits of the tract authorized to be acquired, and to set aside as a public way a strip of land 25 feet wide on the northerly side of the area so acquired by the United States, extending from Elm avenue to Winthrop street, as indicated on accompanying tracing[a] as "proposed private way."

The parties owning the fee in that part of Elm avenue accordingly conveyed to the United States their right, title, and interest therein and thereto by deeds which are recorded in the proper land records, and certain other parties who held easements in that avenue have relinquished their easements by proper deeds. In fencing the reservation the United States excluded the strip of land on the northerly side as described, leaving it open for use as a passageway to the public. This strip of land is not now used by the United States, but it has not been graded and made into a road. The engineer officer in charge of fortification construction at the locality in question states that Elm avenue was an ordinary country road at the time it was taken by the United States.

One party holding property exterior to the tract acquired by the Government has entered suit against the United States in the United States district court for the district of Massachusetts, claiming compensation for the taking of the right of way in Elm avenue. That suit is now pending.

It is submitted that the parties who have released and conveyed to the United States their rights in Elm avenue as a public way with the understanding that the United States would set aside a part of the Government's land as a public way, as well as other landowners who had a right of way over that avenue, are entitled to have a perpetual right of way, which shall be permanent and not liable to be closed at the option or discretion of officers of the Government. It is believed that Congress alone has the power to make such disposition of the land of the United States.

It is further thought that the strip set aside by the Government for such purpose should be graded and made into as good a street or road as Elm avenue was at the time it was closed to travel.

I have therefore the honor to recommend that the matter be presented to Congress with recommendation that a strip of land 25 feet wide, extending along the northerly side of the military reservation at Fort Banks from the easterly side of Elm avenue to the easterly side of Winthrop street, be relinquished and dedicated to the town of Winthrop, in the county of Suffolk and State of Massachusetts, for the purposes of a public highway, and that the sum of $200 be appropriated for the purpose of grading and making a roadway through the middle of said strip of land.

A full description of the strip of land recommended to be so relinquished and dedicated is as follows:

Beginning at the point of intersection of the northeasterly side of Winthrop street with the southeasterly side of the location of the Boston, Revere Beach and Lynn Railroad Company's right of way and running thence northeasterly along the southeasterly side of said right of way for a distance of 600 feet, more or less, to the northeasterly side of Elm avenue; thence southeasterly along the northeasterly side of Elm avenue for a distance of 25 feet; thence southwesterly along a line parallel to and 25 feet distant from the southeasterly line of the location of the Boston, Revere Beach and Lynn Railroad Company's right of way to the northeasterly side of Winthrop street; thence northwesterly along the northeasterly side of Winthrop street to the point of beginning.

[a] Not printed. Printed in House Doc. No. 580, Fifty-seventh Congress, first session.

It is further recommended that these papers be referred to the Judge-Advocate-General of the Army for the drafting of a proper bill or joint resolution to carry the foregoing recommendations into effect.

There are submitted herewith a copy of the authority given by the Secretary of War October 22, 1891, for the acceptance, in behalf of the United States, of the rights and title in Elm avenue, in consideration of setting aside a portion of the Government land as a public way, with a copy of a drawing showing the land to be so set aside; a copy of an opinion rendered by the Attorney-General under date of September 5, 1893, covering the title to the portion of Elm avenue lying within the boundaries of the tract acquired by the United States, with copies of the deeds of William B. Floyd and wife and Lucretia Floyd et al., referred to therein by the Attorney-General, and a copy of a deed of Phillips P. Floyd and wife, executed subsequently to the date of the Attorney-General's opinion, releasing all their rights of way and easements in Elm avenue.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

[Second indorsement.]

WAR DEPARTMENT,
JUDGE-ADVOCATE-GENERAL'S OFFICE,
Washington, D. C., April 23, 1902.

Respectfully returned to the Secretary of War.

It is the practice of the State legislatures, in ceding jurisdiction over lands acquired by the United States for public purposes, to stipulate for the retention of such county roads or other means of communication as are necessary to the public convenience, and such reservations of jurisdiction, when reasonable, are accepted by the United States.

In this case, as the site of the public way under consideration, then Elm avenue, in the town of Winthrop, Mass., was needed for fortification purposes, I concur in the recommendation of the Chief of Engineers that an equivalent way, so situated as not to interfere with the use of the tract for fortification purposes, should be reconveyed to the town of Winthrop. The draft of a bill calculated to accomplish that purpose is submitted herewith.

GEO. B. DAVIS,
Judge-Advocate-General.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of War be, and he hereby is, authorized to convey to the town of Winthrop, in the county of Suffolk, State of Massachusetts, for perpetual use as a public road, the following described tract of land:

A strip of land twenty-five feet wide, extending along the northerly side of the United States military reservation at Fort Banks, from the easterly side of Elm avenue to the easterly side of Winthrop street, town of Winthrop, in the county of Suffolk, Massachusetts, and more particularly described as follows:

"Beginning at the point of intersection of the northeasterly side of Winthrop street with the southeasterly side of the location of the Boston, Revere Beach and Lynn Railroad Company's right of way and running thence northeasterly along the southeasterly side of said right of way for a distance of six hundred feet, more or less, to the northeasterly side of Elm avenue; thence southeasterly along the northeast-

erly side of Elm avenue for a distance of twenty-five feet; thence southwesterly along a line parallel to and twenty-five feet distant from the southeasterly line of the location of the Boston, Revere Beach and Lynn Railroad Company's right of way to the northeasterly side of Winthrop street; thence northwesterly along the northeasterly side of Winthrop street to the point of beginning," the said land being so conveyed to the town of Winthrop in exchange for the land and easements comprised in Elm avenue in said town of Winthrop which was conveyed to the United States in eighteen hundred and ninety-one and eighteen hundred and ninety-two as a site for the construction of fortifications; and with a view to convert the said strip into as good a street as Elm avenue was at the time of its conveyance to the United States, the sum of two hundred dollars is hereby appropriated, to be paid out of any money in the Treasury not otherwise appropriated, to be expended under the direction of the Chief of Engineers, United States Army, for the purpose of grading and making a road upon and through the said strip of land.

Know all men by these presents:

That I, William B. Floyd, of Winthrop, in the county of Suffolk and Commonwealth of Massachusetts, in consideration of $1 and other good and valuable considerations paid by the United States of America, and for the further consideration of $125, the receipt whereof is hereby acknowledged, and also upon the condition hereinafter expressed, do hereby remise, release, and forever quitclaim unto the said United States all my right, title, and interest in and to all that portion of a certain private way called Elm avenue, situated in said Winthrop and lying southerly of a line parallel with the southerly line of the location of the Boston, Winthrop and Shore Railroad and 25 feet distant therefrom in a southerly direction; and I also release unto the said United States all my right of passage over said portion of Elm avenue, and I consent that the same may be forever closed to travel.

This release and consent are made and given upon the condition that the said United States shall lay out, construct, and maintain a public way 25 feet in width, connecting Winthrop street with that portion of Elm avenue lying northerly of said line parallel with and 25 feet distant in a southerly direction from the southerly line of the location of the Boston, Winthrop and Shore Railroad. The location of said public way is shown on the plan [a] hereto annexed and to be recorded herewith entitled "Plan of public way connecting Winthrop street and Elm avenue, Winthrop, Mass."

Said public way is to be as thoroughly constructed as that part of Elm avenue which is to be discontinued, and it is to be completed and opened to public travel by July 1, 1893, or as soon thereafter as shall be reasonably practicable.

To have and to hold the granted premises, with all the privileges and appurtenances thereto belonging to the said United States and its assigns, to their own use and behoof forever.

And I do hereby, for myself and my heirs, executors, and administrators, covenant with the said grantee and its assigns that the granted premises are free from all incumbrances made or suffered by me, and that I will, and my heirs, executors, and administrators shall, warrant and defend the same to the said grantee and its assigns forever against the lawful claims and demands of all persons claiming by, through, or under me, but against none other.

And for the consideration aforesaid I, H. Augusta Floyd, wife of the said William B. Floyd, do hereby release unto said grantee and its assigns all right of or to both dower and homestead in the granted premises.

In witness whereof we, the said William B. Floyd and H. Augusta Floyd, hereunto set our hands and seals this 23d day of May, in the year 1893.

WILLIAM B. FLOYD. [L. S.]
H. AUGUSTA FLOYD. [L. S.]

Signed, sealed, and delivered in presence of—
DAVID FLOYD, 2D.

MAY 24, 1893.

COMMONWEALTH OF MASSACHUSETTS, *Suffolk, ss:*

Then personally appeared the above-named William B. Floyd and acknowledged the foregoing to be his free act and deed before me.

DAVID FLOYD, 2D,
Justice of the Peace.

BOSTON, *September 11, 1893.*

Received and entered with Suffolk deeds, libro 2152, page 283.

Attest:

THOS. F. TEMPLE, *Register.*

[a] Not printed.

DEPARTMENT OF JUSTICE,
Washington, D. C., September 5, 1893.

SIR: I herewith transmit sundry deeds and other papers recently forwarded to this Department by the assistant United States attorney for the district of Massachusetts, relating to the site lately purchased for mortar batteries at Winthrop, Mass. The deeds referred to comprise the following:

(1) Deed of William B. Floyd and wife to the United States, dated May 23 and acknowledged May 24, 1893, quitclaiming all the right, title, and interest of the grantors in and to a certain private way, called "Elm avenue," lying within the boundaries of said site.

(2) Deed of Lucretia Floyd, widow of Edward Floyd, and others to the United States, dated November 24, 1891, and acknowledged June 8, 1893, quitclaiming all the right, title, and interest of the grantors in and to the same private way lying within the boundaries aforesaid.

(3) Deed of Hermon B. Tewksbury and wife to the United States, dated July 21, 1893, and acknowledged same day, quitclaiming all the right, title, and interest of the grantors in and to a certain other private way, called Cherry street, lying within the boundaries aforesaid.

The last-mentioned deed appears to extinguish all outstanding interests in that part of the private way called Cherry street which is situated within the boundaries of said site.

The other deeds above mentioned (1 and 2) extinguish all the interest of the respective grantors therein in so much of the private way called Elm avenue as lies within the same boundaries. As regards this private way, however, there would seem to be still outstanding some interests in the same belonging to other parties, namely, Philips P. Floyd, Sumner Floyd, Jane England, S. G. Irwin, H. E. Mills, and D. H. Blaney.

In my opinion each of the three deeds mentioned is sufficient for the purpose for which it is intended.

I am, sir, very respectfully,

RICHARD OLNEY,
Attorney-General.

THE SECRETARY OF WAR.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
September 8, 1893.

Respectfully referred to Lieut. Col. S. M. Mansfield, Corps of Engineers, who is requested to secure from Philips P. Floyd, Sumner Floyd, Jane England, S. G. Irwin, H. E. Mills, and D. H. Blaney, named herein, deeds releasing their respective interests in Elm avenue.

When payments have been made and proper record made of the deeds herewith these papers should be returned to this office.

H. M. ADAMS,
Acting Chief of Engineers.

[Third indorsement.]

UNITED STATES ENGINEER OFFICE,
Boston, Mass., October 17, 1893.

Respectfully returned to the Chief of Engineers, United States Army.

S. M. MANSFIELD,
Lieutenant-Colonel of Engineers.

Know all men by these presents:

That we, Phillips P. Floyd and Sally A. Floyd, wife of said Phillips P. Floyd, of Winthrop, in the county of Suffolk and Commonwealth of Massachusetts, in consideration of $200 to us paid by the United States of America, the receipt whereof is hereby acknowledged, do hereby remise, release, and forever quitclaim unto the said United States of America all the remaining rights and estate, if any, of either or both of us, including the dower and homestead of said Sally A. Floyd, in and to a certain tract of land situated at what is commonly called Grover's Cliff, in the town of Winthrop, in the county and Commonwealth aforesaid, being the tract of land recently acquired by said United States of America for the site of a mortar battery. The boundary of said entire tract is indicated by a broad shaded black line on a plan marked "Plan showing tract of land in the town of Winthrop, Mass., purchased or

to be purchased by the United States for purposes of national defense, filed in the office of the secretary of the Commonwealth of Massachusets, in accordance with chapter 81 of the acts of 1891, dated February 18, 1892, S. M. Mansfield, lieutenant-colonel of engineers," said plan being now in the office of the secretary of the Commonwealth of Massachusetts and numbered 3050 on the files of said secretary.

And particularly we release, grant, bargain, sell, and convey unto the said United States of America all the rights of way and other easements, if any, of either or both of us in the private way or street commonly called Elm avenue, as shown on said plan.

And for the consideration aforesaid we hereby release the said United States of America from all other claims and demands, if any, of every name and nature that either or both of us may now have against said United States of America.

To have and to hold the granted premises, with all the privileges and appurtenances thereto belonging, to the said United States of America and its assigns, to its and their own use and behoof forever.

In witness whereof we, the said Phillips P. Floyd and Sally A. Floyd, have hereunto set our hands and seals this 19th day of January, in the year 1894.

PHILLIPS P. FLOYD. [SEAL.]
SALLY A. FLOYD. [SEAL.]

Signed, sealed, and delivered in presence of—
SUMNER FLOYD.
(To both.)

JANUARY 19, 1894.

COMMONWEALTH OF MASSACHUSETTS, *Suffolk, ss:*

Then personally appeared the above-named Phillips P. Floyd, and acknowledged the foregoing instrument to be his free act and deed before me.

SUMNER FLOYD,
Justice of the Peace.

BOSTON, *February 20, 1894.*

Received and entered with Suffolk deeds, libro 2180, page 527.
Attest:
THOS. F. TEMPLE, *Register*

Know all men by these presents:

That we, Lucretia Floyd, widow of Edward Floyd; David Floyd, 2d; Adelaide M. Floyd, Lucy A. Floyd, Harriet S. Floyd, Phillips P. Floyd, Mary Floyd, widow of John Floyd, all of Winthrop, in the county of Suffolk; Henry Barber, and Eliza F. Barber, wife of the said Henry, in her right, of Boston, in said county; Sarah Smith, of said Boston; John W. Covell and Charlotte F. Covell, wife of said John, in her right, of Malden, in the county of Middlesex, all in the Commonwealth of Massachusetts, in consideration of $1 to us paid by the United States of America, the receipt whereof is hereby acknowledged, do hereby remise, release, and forever quitclaim unto the said United States all our right, title, and interest in and to a certain parcel of land situated in said Winthrop, being a part of a strip of land known as Elm avenue, and being shown on a plan dated November 23, 1891, signed by S. M. Mansfield, lieutenant-colonel of engineers, to be recorded herewith, being the parcel marked "Elm ave., private way," and extending from Revere street to the "public way" shown on said plan.

Said parcel is further described as follows: Bounded northeasterly by land, now of the United States, formerly of Jane England, Phillips P. Floyd, Sumner Floyd, and William B. Floyd; southeasterly by Revere street; southwesterly by land, now of the United States, formerly of Anna B. Stanley, Agnes L. Comer, heirs of Edward Floyd, David H. Blaney, Henry E. Mills, and S. G. Irwin, and northwesterly by a part of said passageway shown on said plan by a red line, and being the easterly boundary of the "public way:"

To have and to hold the granted premises, with all the privileges and appurtenances thereto belonging, to the said United States and its assigns, to their own use and behoof forever.

And we do hereby, for ourselves and our heirs, executors, and administrators, covenant with the said grantee and its assigns that the granted premises are free from all incumbrances made or suffered by us, and that we will, and our heirs, executors,

and administrators shall, warrant and defend the same to the said grantee and its assigns forever against the lawful claims and demands of all persons claiming by, through, or under us, but against no other.

And for the consideration aforesaid we, Sallie A. Floyd, wife of the said Phillips, and Belle A. Floyd, wife of the said David, do hereby release unto the said grantee and its assigns all right of or to both dower and homestead in the granted premises.

In witness whereof we, the said Lucretia Floyd, David Floyd, 2d, Adelaide M. Floyd (unmarried), Lucy A. Floyd (unmarried), Harriet S. Floyd (unmarried), Phillips P. Floyd, Mary Floyd, Henry Barber, Eliza F. Barber, Sarah Smith (widow), John W. Covell, Charlotte F. Covell, Sallie A. Floyd, and Belle A. Floyd, hereunto set our hands and our common seal this 24th day of November, in the year 1891.

Signed, sealed, and delivered in presence of—

LUCRETIA FLOYD. [L. S.]
DAVID FLOYD, 2D.
ADELAIDE M. FLOYD.
LUCY A. FLOYD.
HARRIET S. FLOYD.
HENRY BARBER.
ELIZA F. BARBER.
SARAH A. SMITH.
BELLE A. FLOYD.
MARY FLOYD,
JOHN W. COVELL.
CHARLOTTE F. COVELL.

JUNE 8, 1903.

COMMONWEALTH OF MASSACHUSETTS, *Suffolk, ss:*

Then personally appeared the above-named David Floyd, 2d, and acknowledged the foregoing instrument to be his free act and deed, before me—

HENRY A. WYMAN,
Justice of the Peace.

BOSTON, *September 11, 1893.*

Received and entered with Suffolk deeds, liber 2152, page 281.
Attest:
THOS. F. TEMPLE, *Register.*

OFFICE OF UNITED STATES ATTORNEY,
Boston, March 9, 1894.

SIR: In pursuance of instructions from the Attorney-General, I have this day caused the suit of the United States *v.* Certain Lands in Winthrop, district court No. 434, to be discontinued.

This step was taken because a good title has been obtained to all the land for the Government, and so far as any easements of persons living outside the tracts are concerned it was deemed wiser to let these persons take the initiative, if they think that they have any rights and that their rights are worth anything, than to put the Government to the expense of filing another petition for the condemnation of such speculative and doubtful interests.

Very respectfully,

SHERMAN HOAR.

Lieut. Col. S. M. MANSFIELD,
Post-Office Building, Boston.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., October 16, 1891.

GENERAL: I have the honor to report, in reference to the acquisition of the land for site of mortar batteries at Grovers Cliff, Mass., that the parties owning the fee in Elm avenue, a private way crossing about the middle of the site, are willing to deed all their right, title, and interest in and to said Elm avenue, south of the Winthrop Shore Railroad, in exchange for a right of way running parallel with and south of said Winthrop Shore Railroad, between the northerly side of Elm avenue, where it crosses the railroad, and Cherry street, as will appear on the accompanying tracing.

This proposition seems to be very favorable to the United States, and least interferes with its property. The United States must have the fee in Elm avenue, and this arrangement is a very easy way out of the difficulty, and will give those owning rights in Elm avenue equally good means of access to their estates beyond the railroad, rights which it can hardly be expected they will voluntarily surrender.

I have respectfully to request full authorization from the Department before completing negotiations, as some sort of covenant must be entered into.

Very respectfully, your obedient servant,

S. M. MANSFIELD,
Lieutenant-Colonel, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers U. S. Army,
Washington, D. C.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS U. S. ARMY,
October 20, 1891.

Respectfully submitted to the Secretary of War, recommending that Lieut. Col. S. M. Mansfield, Corps of Engineers, be authorized to accept in behalf of the United States the donation of all private right, title, and interest to Elm avenue, south of the Winthrop Shore Railroad, and to set aside as a public way the portion of the site of mortar batteries at Grovers Cliff indicated on the tracing herein as "Proposed private way."

THOS. LINCOLN CASEY,
Brigadier-General, Chief of Engineers.

[Second indorsement.]

WAR DEPARTMENT, *October 22, 1891.*

The recommendation of the Chief of Engineers is approved.

By order of the Secretary of War:

JOHN TWEEDALE, *Chief Clerk.*

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS U. S. ARMY,
October 23, 1891.

Respectfully returned to Lieutenant-Colonel Mansfield, inviting attention to preceding indorsements, by which he will be guided.

Before acceptance of title, the title papers must be submitted for the action of the Attorney-General, as in cases of purchases of land.

When such record as may be necessary has been made, these papers will be returned to this office.

By command of Brigadier-General Casey:

JOHN G. D. KNIGHT,
Captain, Corps of Engineers.

[Fourth indorsement.]

UNITED STATES ENGINEER OFFICE,
Boston, Mass., October 26, 1891.

Respectfully returned to the Chief of Engineers United States Army, in accordance with third indorsement.

S. M. MANSFIELD,
Lieutenant-Colonel of Engineers.

2 D.

DEFENSES OF SOUTHEAST COAST OF MASSACHUSETTS AND RHODE ISLAND AT NEW BEDFORD, MASS., AND NEWPORT, R. I.

Officer in charge, Maj. George W. Goethals, Corps of Engineers; assistant, Lieut. Robert P. Johnston, Corps of Engineers, until August 10, 1901; Division Engineer, Col. Charles R. Suter, Corps of Engineers.

NEW BEDFORD, MASSACHUSETTS.

Gun emplacements.—At the beginning of the fiscal year the two 8-inch gun emplacements were in charge of the artillery, and the emplacements for the two 5-inch and four 4-inch rapid-fire guns were practically completed.

During the fiscal year just ended construction work consisted of repairing the bomb proof of the west 5-inch gun emplacements, repairing the angle of the east wing wall, and placing hand rails in rear of the gun platforms. This battery is still waiting for the guns.

Money statement.

July 1, 1901, balance unexpended		$1,668.66
June 30, 1902, amount expended during fiscal year	$769.24	
Returned to United States Treasury	899.42	
		1,668.66

On the 3-inch rapid-fire batteries, there remains the finishing of the top steps to the gun platforms and the platforms themselves, this work being deferred until the receipt of the base rings. The doors were hung and painted during the fiscal year, and emplacements repaired where settlement had occurred after very heavy rains.

Money statement.

July 1, 1901, balance unexpended	$4,841.37
June 30, 1902, amount expended during fiscal year	4,602.48
July 1, 1902, balance unexpended and available	238.89

Preservation and repair of fortifications.—Under allotments from this appropriation, iron and wood work have been painted, lifts repaired, minor repairs made to drains, and drains cut on platforms of 8-inch emplacements and in various rooms and passages. The most important work was the lining of the magazines of the 8-inch emplacements so as to prevent water percolating through the masses from collecting on the magazine floors. Walls of brick and ceilings of sheet copper were used for the purpose, and very successfully.

Money statements.

GENERAL WORK OF REPAIR.

July 1, 1901, balance unexpended	$809.93
June 30, 1902, amount expended during fiscal year	732.00
July 1, 1902, balance unexpended and available	77.93

PREVENTION OF DAMPNESS IN BATTERIES.

July 1, 1901, balance unexpended	$150.00
Returned to United States Treasury	150.00

CARE OF TORPEDO MATERIAL.

July 1, 1901, balance unexpended		$17.15
June 30, 1902, amount expended during fiscal year	$2.50	
Returned to United States Treasury	14.65	
		17.15

Torpedo material.—The cable was tested during the month of January, 1902, and transferred to the artillery, thereby completing the transfer of all material for this purpose at that locality.

Money statement.

July 1, 1901, balance unexpended		$150.00
June 30, 1902, amount expended during fiscal year	$116.80	
Returned to United States Treasury	33.20	
		150.00

Mining casemate.—The casemate leaked badly and was lined in the same way as the magazines of the 8-inch gun emplacements with brick walls and sheet-copper ceiling, with equally good results. The casemate was wired, thereby completing all necessary work except the setting up of the engine, which it was thought best to leave dismantled until required. The casemate has been transferred to the artillery.

Money statement.

July 1, 1901, balance unexpended		$995.82
June 30, 1902, amount expended during fiscal year	$948.14	
Returned to United States Treasury	47.68	
		995.82

Torpedo storehouse.—A building of brick with slate roof supported by steel trusses was completed at the beginning of the fiscal year, with the exception of the following, which was done during the past year, thereby finishing the storehouse: Hanging doors and shutters, building racks for mines, placing traveler and trolley, and connecting the railroad within the building to that on the wharf. This building has been transferred to the artillery.

Money statement.

July 1, 1901, balance unexpended		$2,095.66
June 30, 1902, amount expended during fiscal year	$2,001.06	
Returned to United States Treasury	94.60	
		2,095.66

Range-finder station.—Under date of June 16, 1902, an allotment of $2,365 was made for the erection of a range-finder station, instrument type A, for temporary protection of an azimuth instrument and for laying out a horizontal base line. As the range finder is to be used in connection with the maneuvers in the fall, the base and pedestal for the instrument are to be made permanent, but the house only a temporary structure. No work has as yet been done.

Money statement.

June 30, 1902, amount allotted since July 1, 1901	$2,365.00
July 1, 1892, balance unexpended	2,365.00

Fire-control system and searchlight.—Under date of June 17, 1902, the sum of $3,400 was allotted for installing the telautograph and telephone cables and for the temporary installation of a 24-inch searchlight for use in connection with the maneuvers. Requisition was made on June 5, 1902, for the telautograph and telephone cable, which is to be furnished by the Signal Corps, and orders were placed for the power cables. A small engine plant will be used for furnishing the necessary current.

Money statement.

June 30, 1902, amount allotted since July 1, 1901	$3,400.00
July 1, 1902, outstanding liabilities	42.15
July 1, 1902, balance available	3,357.85

NARRAGANSETT BAY, RHODE ISLAND.

Electric-light plants.—The money allotted under date of November 27, 1900, for the installation of a central electric-light plant at the defenses of the eastern entrance, and under which allotment work was begun during the past fiscal year, has been expended for the purposes for which allotted, and an additional allotment of $5,000 was made under date of May 1, 1902, from funds in hand for the completion of the work. The plant is completed, and but for the failure of some of the cells of the storage battery to come up to the requirements of the specifications, and which the company proposes to make good, the plant is ready for transfer to the artillery for use. The plant is designed to furnish light to the various batteries, to the searchlights, and alternately for garrison and post purposes. It consists of a central power house of brick, with slate roof supported by steel trusses for the boiler and generating sets, and an independent storage-battery house, also of brick and slate roof; this latter structure was made necessary by reason of the difficulty experienced in keeping a storage battery in good working condition in the wet rooms of the emplacements. Steam is furnished by a Worthington water-tube boiler and power by two 30-kilowatt General Electric Company's dynamos and engines, which were substituted for generators to be furnished under contract by the McCay Engineering Company when they failed to furnish sets complying with the requirements of the specifications. The storage batteries are of the electric chloride and Willard types. All the wires are underground in vitrified ducts. The number of building and post lights, as furnished by the Quartermaster's Department when the estimates were first prepared, has been very materially increased and the plant is now taxed to its utmost. Provision has been made in the power house for duplication of the plant and for increasing the capacity of the storage battery up to the maximum now adopted as the standard.

Money statement.

July 1, 1901, balance unexpended		$43,807.60
June 30, 1902, amount allotted since		5,000.00
		48,807.60
June 30, 1902, amount expended during fiscal year		41,245.16
July 1, 1902, balance unexpended		7,562.44
July 1, 1902, outstanding liabilities	$805.03	
July 1, 1902, amount covered by uncompleted contracts	3,100.00	
		3,905.03
July 1, 1902, balance available		3,657.41

On March 15, 1901, $31,020 were allotted for the installation of an electric-light plant at defenses of the western passage. During the past fiscal year contracts were entered into for furnishing the necessary material, the power house has been completed, ducts laid to the various batteries, and cable drawn for military purposes only. Interior wiring of the batteries is completed. The power house is built of concrete throughout, with an earth covering to make it bombproof. A Worthington water-tube boiler is installed, also one 30-kilowatt General Electric Company's generating set, and steam

connections between it and the boiler are practically completed. The plant, when completed, is to consist of two such generating sets, but one is now at defenses for the eastern entrance for use in furnishing power during the contemplated combined military and naval maneuvers in the fall. Nothing has as yet been done toward laying the cable for garrison and post lighting, as great delay has been experienced in procuring the necessary cable and all efforts have been directed mainly toward the completion of works necessary for the maneuvers.

Money statement.

July 1, 1901, balance unexpended		$37,895.25
June 30, 1902, amount expended during fiscal year		21,716.58
July 1, 1902, balance unexpended		16,178.67
July 1, 1902, outstanding liabilities	$8,043.12	
July 1, 1902, amount covered by uncompleted contracts	5,425.00	
		13,468.12
July 1, 1902, balance available		2,710.55

Contracts in force.

Material.	Contractor.	Date of approval.	To commence.	To complete.
		1901.		
Conduit, switches, junction boxes, lamps, etc.	The Burnet Co., New York, N. Y.	Apr. 25	Within 30 days	Within 60 days after commencement.
Generator and accumulator switch boards.	H. B. Coho & Co., New York, N. Y.	May 1	do	Within 45 days after commencement; extended 30 days.
Cable	Standard Underground Cable Co., Pittsburg, Pa.	May 4	do	Within 30 days.
Two 30-kilowatt generating sets.[a]	McCay Engineering Co., Baltimore, Md.	May 11		Within 10 weeks.
One 60-cell accumulator.	Sipe & Sigler, Cleveland, Ohio.	May 16		To be delivered when ordered.
Two generating sets[a]	McCay Engineering Co., Baltimore, Md.	Aug. 30		Within 60 days after notification. Notified Sept. 20, 1901.
Conduit, etc	Standard Underground Cable Co., Pittsburg, Pa.	Aug. 12		25 days after notification. Notified Aug. 14.
One 66-cell accumulator.	Sipe & Sigler, Cleveland, Ohio.	do		Delivery when called for.
One 125-h. p. boiler	New York Safety Steam-Power Co., New York.	Sept. 10		60 days after notification.
Generator and accumulator switch boards.	Helios-Upton Co	Oct. 1		40 days after notification. Notified Oct. 3, 1901.
Cable, lamp boxes, etc.	The Burnet Co., New York, N. Y.	Sept. 3	30 days	40 days after commencement.
Generating sets[a]	McCay Engineering Co., Baltimore, Md.	Emergency.		Feb. 15, 1902.

[a] Generating sets rejected and bought in open market.

Sea walls and embankments.—Under a contract entered into with Mr. Eugene S. Belden, of Hartford, Conn., near the close of the last fiscal year, a sea wall was built consisting of 160 linear feet of riprap granite carefully laid and 1,115 linear feet of rubble masonry built up with Portland cement mortar. Under the terms of the contract 1,254 tons of riprap stone and 1,510.9 cubic yards of masonry were placed in position.

Money statement.

July 1, 1901, balance unexpended	$13,000.00
June 30, 1902, amount expended during fiscal year	13,000.00

Contract in force.

Work.	Contractor.	Date of approval.	To commence.	To complete.
Building sea wall	Eugene S. Belden, Hartford, Conn.	July 15	In 30 days	In 4 months.

Three 12-inch gun emplacements.—Under date of July 8, 1901, the sum of $240,000 was allotted for the construction of three 12-inch gun emplacements, and a contract was made for the construction of a timber wharf on piles built in the form of an L and extending out into 18 feet of water. The arm toward the shore is 130 feet on the inside, 160 feet on the outside, and 40 feet wide. The arm parallel to the shore is 115 feet on the outside and 30 feet wide. The wharf is connected with the mainland by a causeway built of rock excavated from the site of the battery, 520 feet long, 50 feet wide on top, with side slopes of 1 on 1. The west slope was being washed down by the action of the currents, and 250 feet has been riprapped with heavy stones to prevent this action. At the close of the fiscal year the excavation for the 12-inch battery was completed, and the stone not used in the causeway was piled up as a retaining wall up to the height of the exterior crest and well grouted with Portland cement mortar. All the rooms of the east emplacement are finished up to the ceiling line, ceiling tiles placed and tied into the concrete, concrete placed up to the waterproofing level, and about half the rooms of the middle emplacement are in the same condition. The gun platforms of these two emplacements are finished, ready for placing the base rings. Foundations are in place for the walls throughout the battery and the bottoms of the air spaces finished. As work progressed the earth covering of the parapet was carried up and is finished, ready for sodding up to the exterior crest.

Money statement.

June 30, 1902, amount allotted since July 1, 1901		$240,000.00
June 30, 1902, amount expended during fiscal year		[a] 80,191.08
July 1, 1902, balance unexpended		159,808.92
July 1, 1902, outstanding liabilities	$10,113.62	
July 1, 1902, amount covered by uncompleted contracts	32,774.45	
		42,888.07
July 1, 1902, balance available		116,920.85

Three 10-inch gun emplacements.—Allotments for the construction of two of these emplacements were made during the previous fiscal year and for the third under date of July 16, 1901, from funds appropriated by the act of March 1, 1901. Very little had been done during the last fiscal year other than building a small piece of road due to a suit for damages, based on negative easements, pending in the United States courts, but on telegraphic instructions received from the Chief of Engineers May 28, 1901, contracts for material were made and work begun. Permission was obtained from the town council to grade the road, so as to facilitate hauling the material from the wharf to the site of the work, and the grading is done. The necessary buildings, consisting of office, cement shed, blacksmith shop, tool house, etc., are completed. The foundation of the battery is granite rock, and 12,300

[a] $3,500 withdrawn.

cubic yards were removed to secure the necessary grade for the foundation of the emplacements. The bottoms of the air spaces are laid, as well as the foundations of all the walls. The walls are of Shawnee brick backed with one course of red brick, and are practically completed up to the ceiling level. In this battery the walls of all the magazines are of brick throughout, the other rooms being concrete with brick lining. One platform is ready for its ring, and forms are erected for the other two. The parapet walls in front of the air spaces are built of Portland cement concrete up to the ceiling lines, outside of which stone taken from the excavation has been piled to dispose of the material needed to form part of the parapet. Earth in the locality of this battery is very scarce.

Money statement.

July 1, 1901, balance unexpended		$121,997.00
June 30, 1902, amount allotted since		55,800.00
		177,797.00
June 30, 1902, amount expended during fiscal year		[a] 64,510.06
July 1, 1902, balance unexpended		113,286.94
July 1, 1902, outstanding liabilities	$3,253.08	
July 1, 1902, amount covered by uncompleted contracts	5,202.97	
		8,456.05
July 1, 1902, balance available		104,830.89

Emplacements for four 6-inch rapid-fire guns.—These emplacements are disposed in two batteries of two guns each. For one of the batteries an allotment of $35,000 was made June 19, 1901, and during the past fiscal year the battery has been practically completed, ready for the guns.

Money statement.

July 1, 1901, balance unexpended	$35,000.00
June 30, 1902, amount expended during fiscal year	31,178.42
July 1, 1902, balance unexpended	3,821.58
July 1, 1902, outstanding liabilities	1,661.63
July 1, 1902, balance available	2,159.95

For the other battery an allotment of $33,880 was made August 14, 1901, and the excavation for the emplacement is completed.

Money statement.

June 30, 1902, amount allotted since July 1, 1901	$33,880.00
June 30, 1902, amount expended during fiscal year	7,491.46
July 1, 1902, balance unexpended	26,478.54
July 1, 1902, outstanding liabilities	1,018.97
July 1, 1902, balance available	25,459.57

Emplacements for two 3-inch rapid-fire guns.—Allotments amounting to $15,000 were made for the construction of two 3-inch rapid-fire gun emplacements under dates of November 9 and 24, 1900. Work was delayed because of the suit for damages, as explained above, for the 10-inch gun emplacements, until nearly the close of the fiscal year. The battery is practically completed except setting the bolts for the

[a] $1,905.40 transferred to electric-light plant for defenses of eastern entrance.

base ring. It is lined throughout with Shawnee brick, and 6-inch air spaces are provided.

Money statement.

July 1, 1901, balance unexpended	$15,000.00
June 30, 1902, amount expended during fiscal year	14,345.23
July 1, 1902, balance unexpended	654.77
July 1, 1902, outstanding liabilities	629.75
July 1, 1902, balance available	25.02

Contracts in force.

Material.	Contractor.	Date of approval.	To commence—	To complete—
Cement	The Atlas Portland Cement Co., New York, N. Y.	Emergency		Delivery as called for.
Sand and stone	J. K. Sullivan, Newport, R. I.	do		Do.
Transportation and team hire.	Peckham & Head, Jamestown, R. I.	do		Do.
Book tiles	National Fire Proofing Co., Pittsburg, Pa.	do	May 3, 1902	May 18, 1902.
Constructing wharf	Joseph C. Terry, Fall River, Mass.	do	Sept. 23, 1901	90 days.

Battery of eight 12-inch mortars.—This battery is completed and was formally transferred for use and care to the artillery on January 22, 1901, but certain work remained to be done in clearing the ground in rear of the battery and in repairing the parapets, which had been damaged by very heavy rains. Repairs to the parapets have been completed, and the grounds in rear of the battery have been cleared as far as the construction of the central power plant, adjacent to it, would permit.

Money statement.

July 1, 1901, balance unexpended	$499.75
June 30, 1902, amount expended during fiscal year	429.95
July 1, 1902, balance unexpended and available	69.80

Preservation and repair.—During the past fiscal year, under the allotments received for this purpose, work has been confined, with the exception of the mortar battery and the 10-inch battery, to painting the iron and wood work connected with the batteries, and other minor repairs. An effort was made to stop the leakage in the magazines of the mortar battery by a lining consisting of brick walls with copper ceiling, similar to that used at New Bedford, Mass. In this battery no drains existed, and drains were cut so as to carry off the water that would be collected in the gutter built at the foot of the magazine walls, but the estimates did not include the laying of a new floor, as was done in the case at New Bedford. Due to the excessive leakage in this battery, the side walls and ceilings are kept at such a low temperature that moisture resulting from condensation has been very considerable, and the floor shows moisture which by capillary attraction is drawn from the original side walls of the magazines. The lining built has succeeded in entirely stopping percolation of water. The shell rooms of this battery were so wet as to require considerable labor in keeping the projectiles in suitable condition for service. An allotment of $1,325 was made for the construction of a storage house for

the projectiles, and a wooden structure was built for this purpose. All projectiles are now stored in this temporary structure. The platform of the 10-inch battery has a concrete projection extending over the earth embankment, which by settlement caused the concrete on top to become badly cracked. Part of this concrete has been relaid.

Money statements.

GENERAL WORK OF REPAIR.

July 1, 1901, balance unexpended	$6,562.53
June 30, 1902, amount allotted since	1,725.00
	8,287.53
June 30, 1902, amount expended during fiscal year	6,230.76
July 1, 1902, balance unexpended and available	2,056.77

CARE OF TORPEDO MATERIAL.

July 1, 1901, balance unexpended	$34.41
June 30, 1902, amount allotted since	600.00
	634.41
June 30, 1902, amount expended during fiscal year	434.41
July 1, 1902, balance unexpended and available	200.00

PREVENTION OF DAMPNESS IN BATTERIES.

July 1, 1901, balance unexpended	$176.00
June 30, 1902, amount expended during fiscal year	176.00

SALARY OF ELECTRICIAN.

June 30, 1902, amount allotted since July 1, 1901	$1,200.00
July 1, 1902, balance unexpended and available	1,200.00

STORAGE SHED FOR PROJECTILES.

June 30, 1902, amount allotted since July 1, 1901		$1,325.00
June 30, 1902, amount expended during fiscal year	$1,303.57	
Returned to United States Treasury	21.43	
		1,325.00

Torpedo storehouse.—The construction of a torpedo storehouse, begun during the last fiscal year under an allotment of $4,000, made March 19, 1901, has been completed. It is a brick structure with slate roof supported by steel trusses, of sufficient size to store all the torpedo material required for the submarine-mine defense of the western passage. There still remains to be done under the allotment the connection of this storehouse with the end of the wharf by means of a railway track, which is on hand but not placed, because the wharf has not been sufficiently clear of material required for other purposes to enable this being done.

Money statement.

July 1, 1901, balance unexpended	$3,701.00
June 30, 1902, amount expended during fiscal year	3,683.88
July 1, 1902, balance unexpended and available	17.12

Cable tank.—Work was begun under an allotment of $4,000, made March 19, 1901, during the last fiscal year, for the construction of a

cable tank for the storage of the cable required for the submarine-mine defense of the western passage. During the fiscal year the cable tank has been completed, but lacks the laying of the track, as in the case of the torpedo storehouse.

Money statement.

July 1, 1901, balance unexpended	$3,607.92
June 30, 1902, amount expended during fiscal year	3,367.37
July 1, 1902, balance unexpended and available	240.55

Torpedoes for harbor defense.—At the close of the last fiscal year all torpedo material on hand, with the exception of cable, had been transferred to the artillery, in compliance with instructions of the Chief of Engineers dated February 23, 1901. During the past fiscal year all cable on hand was tested in the presence of an officer of artillery and transferred. An expert electrician has been employed in connection with the torpedo material.

Money statement.

July 1, 1901, balance unexpended		$170.00
June 30, 1902, amount expended during fiscal year	$114.71	
Returned to United States Treasury	55.29	
		170.00

Construction of wharf.—An allotment of $28,500 was made for the purpose of reconstructing the wharf for use in landing materials for the construction of gun emplacements, and the wharf has been completed. It is in the shape of an L, and its dimensions are 240 feet out from shore, 82.6 feet on the exterior parallel to the shore, and 34 feet wide. It is of heavy stones, laid up as retaining walls on the exterior, and filled with rock obtained from the excavation of the 10-inch and 6-inch gun emplacements. The balance available was transferred for completing the electric-light plant at the eastern entrance.

Money statement.

July 1, 1901, balance unexpended	$20,893.94
June 30, 1902, amount expended during fiscal year	[a] 20,893.94

Range-finder stations.—Under date of November 19, 1901, an allotment of $2,277 was made for the construction of a fire commander's station at the defenses for the eastern entrance. This is a brick structure, concrete pedestal, with platform of wood, and roof constructed of twisted steel and glass in concrete. This was completed at the close of the fiscal year, excepting interior plastering and arrangement for fastening slot shutters when closed.

An allotment of $3,200 was made, under date of December 16, 1901, for the construction of a battery commander's station for the 12-inch gun battery. This is completed, excepting roof and shutters, which are of a temporary nature, to be replaced after the combined maneuvers with concrete and iron.

With an allotment of $2,153.80, made under date of November 4, 1901, a fire commander's station, similar to that described above, was completed at the defenses of the western passage, excepting the finishing of the wooden platform surrounding the pedestal for the instrument, the arrangement for fastening slot shutters when closed, and some of the interior tiling.

[a] $3,094.60 transferred for completing electric-light plant at the eastern entrance.

A battery commander's station was begun, under an allotment of $2,376, made November 21, 1901, but application being made for changing its location and for increasing the height of the axis of the instrument, work was suspended until this question was decided, after conference with the district artillery commander, in compliance with instructions from the Chief of Engineers. Revised plans and estimates were submitted, necessitating an additional allotment of $2,650, which was made under date of May 3, 1902. The station is of brick, pedestal of concrete, roof of concrete with embedded twisted steel bars and glass, interior of instrument room of enameled brick, stairway to instrument room of concrete, with I-beams and twisted steel supports, and doors and shutters of iron. At the close of the fiscal year the station was completed, except floor in instrument room, which is of concrete, railing to stairway, and arrangement for fastening slot shutters.

Money statement.

June 30, 1902, amount allotted since July 1, 1901	$12,656.80
June 30, 1902, amount expended during fiscal year	4,832.64
July 1, 1902, balance unexpended	7,824.16
July 1, 1902, outstanding liabilities	2,175.55
July 1, 1902, balance available	5,648.61

Fire-control system.—Under dates of May 14 and June 17, 1902, $7,500 were allotted for the work necessary for the installation of the telautograph and telephone systems connecting the various fire commanders' stations at the defenses of the eastern entrance with their respective batteries and with each other. The trenches for the ducts were completed at the close of the fiscal year, ready for the cables or ducts, whichever was received first. Due to the difficulty of procuring the ducts, in certain localities cables will be laid in ducts on concrete base throughout; in others the base will be laid and the cables placed with timber protection as a temporary expedient until after the maneuvers.

For the defenses of the western entrance an allotment of $2,200 was made under date of May 14, 1902, and the ducts are laid ready for the cable. The cable is to be supplied by the Signal Corps, and is to be drawn in and jointed by the Engineer Department.

None of the cable has been received. A survey for connecting the fire commanders' stations with each other and with the guns of the various batteries was made, and two dolphins were driven for use in connection with the stations.

Money statement.

June 30, 1902, amount allotted since July 1, 1901	$9,700.00
June 30, 1902, amount expended during fiscal year	579.99
July 1, 1902, balance unexpended	9,121.01
July 1, 1902, outstanding liabilities	2,283.96
July 1, 1901, balance available	6,837.05

Supplies for seacoast defenses.—Under the provisions of the appropriation for "Supplies for Seacoast Defenses," act of May 25, 1900, an allotment of $800 was made June 7, 1900. These funds are expended in furnishing supplies on approved requisitions of the Coast Artillery.

Money statement.

July 1, 1901, balance unexpended	$752.00
June 30, 1902, amount expended during fiscal year	49.81
July 1, 1902, balance unexpended and available	702.19

Sites for fortifications and seacoast defenses.—The site for the defenses projected for the western passage, and the acquisition of which was pending at the close of the last fiscal year (see Annual Report of the Chief of Engineers for 1901, p. 746), was paid for under date of August 3, 1901, and the site marked by stone bounds.

Under date of September 4, 1901, the Chief of Engineers directed that a report be submitted showing what land was needed for completing the projected defenses for the eastern entrance. Under date of October 31, 1901, authority was received to enter into negotiations for the acquisition of 20½ acres of land with the existing improvements. Satisfactory agreements were reached with two of the owners; friendly condemnation proceedings were instituted, made necessary by reason of defective titles, and under dates of January 4, 1902, and of February 15, 1902, decrees of condemnation were entered in the cases of these two tracts. The awards, amounting to $9,000 and $6,500, were entered and paid on January 17, 1902, and May 10, 1902, respectively.

The price asked for the remaining tracts, amounting to about 18⅛ acres, was considered exorbitant, and the matter was placed in the hands of the Department of Justice for acquisition through condemnation proceedings. The decree of condemnation was entered April 26, 1902, but the question of award remains as yet unsettled.

Money statement.

July 1, 1901, balance unexpended		$65,313.21
June 30, 1902, amount allotted since		16,000.00
		81,313.21
June 30, 1902, amount expended during fiscal year	$80,740.44	
Returned to the United States Treasury	112.17	
		80,852.61
July 1, 1902, balance unexpended and available		460.60

Temporary installation of searchlights.—In compliance with instructions from the Chief of Engineers, under date of February 6, 1902, nine searchlights were borrowed from the officer in charge of the defenses of New York Harbor, which, with those on hand, are to be installed for use during the combined military and naval maneuvers to take place in the fall. Under date of May 7, 1902, the sum of $3,500 was allotted for the purchase of the necessary cable, connections, etc., in order to accomplish this. At the close of fiscal year the lights were all on hand; the cable, switches, receptacle boxes, etc., were ordered, and all arrangements were made for installation on receipt of cable.

Money statement.

June 30, 1902, amount allotted since July 1, 1901	$3,500.00
June 30, 1902, amount expended during fiscal year	30.10
July 1, 1902, balance unexpended	3,469.90
July 1, 1902, amount covered by outstanding liabilities	446.33
July 1, 1902, balance available	3,023.57

2 E.

DEFENSES OF EASTERN ENTRANCE TO LONG ISLAND SOUND AND COAST OF CONNECTICUT.

Officers in charge: Maj. Smith S. Leach, Corps of Engineers, until January 7, 1902, and Maj. Charles F. Powell, Corps of Engineers, since that date; assistant, Lieut. Edward H. Schulz, Corps of Engineers, until November 5, 1901; Division Engineer, Col. Charles R. Suter, Corps of Engineers.

DEFENSES OF NEW LONDON.

Fort Trumbull.—A minor repair was made to the oil engine of electric-power plant.

Money statement.

PRESERVATION AND REPAIR OF FORTIFICATIONS.

July 1, 1901, balance available		$250.00
June 30, 1902, amount expended during fiscal year	$0.60	
March 17, 1902, amount transferred to other works	249.40	
		250.00

Fort Griswold.—Repairs were made to the ordnance-sergeant's quarters at a cost of $185.

Money statement.

PRESERVATION AND REPAIR OF FORTIFICATIONS.

July 1, 1901, balance available	$185.00
June 30, 1902, amount expended during fiscal year	185.00

Contract in force.

Name of contractor: Frank P. Denison, Groton, Conn.
Date of contract: August 7, 1901.
Work begun and completed in August, 1901.
Character of contract: Emergency; repair of buildings.
Rate: $183 for all.

DEFENSES OF EASTERN ENTRANCE TO LONG ISLAND SOUND.

SITE NO. 1.

A creosoted-timber bulkhead was built on south shore for protection of bank in front of batteries against wash of sea. The wharf was repaired by replanking at places and adding fender piles. A temporary power house was built, generating plant and searchlights borrowed from another district were set up, and searchlights connected temporarily and tested. At the 8-inch battery a steam heating plant was installed to reduce condensation in rooms, drainage means were provided for the manning parade, the asphalt surface of gun platform was repaired, and some of gallery walls and ceilings were coated with a mixture of waterproofing cement and asphalt.

Money statements.

GUN AND MORTAR BATTERIES.

Searchlight.

May 31, 1902, amount allotted		$1,700.00
June 30, 1902, amounted expended during fiscal year		110.38
July 1, 1902, balance unexpended		1,589.62
July 1, 1902, outstanding liabilities		721.12
July 1, 1902, balance available		868.50

Three base stations.

July 17, 1902, amount allotted		$750.00
July 1, 1902, balance available		750.00

PRESERVATION AND REPAIR OF FORTIFICATIONS.

Waterproofing, drainage, etc.

July 1, 1901, balance unexpended		$1,500.00
June 30, 1901, amount expended during fiscal year	$1,050.81	
March 3 and May 21, amount transferred to other works	447.19	
		1,498.00
July 1, 1902, balance unexpended		2.00
July 1, 1902, outstanding liabilities		2.00

Wharf.

December 24, 1901, amount allotted		$200.00
June 30, 1902, amount expended during fiscal year	$113.57	
May 21, 1902, amount transferred to other works	86.43	
		200.00

Repairing slopes, painting ironwork, etc.

July 1, 1901, balance available		$100.00
June 30, 1902, amount expended during fiscal year		100.00

SEA WALLS AND EMBANKMENTS.

July 1, 1901, balance unexpended		$2,583.03
June 30, 1902, amount expended during fiscal year		2,583.03

Contract in force.

Name of contractor: T. A. Scott, New London, Conn.
Date of contract: July 15, 1901.
Date of approval: July 30, 1901.
Work completed: October 1, 1901.
Character of contract: Constructing sheet piling revetment.
Rate: $6 per linear foot.

SITE NO. 2.

At three batteries the electrical installation was completed. Full memoir sheets were approved, and the electric plant was transferred to the artillery December 7, 1901. The batteries had been under care of the troops since March 7, 1901. A steam heating system, operated through a regulating valve from the boilers of the power plant, was installed at two batteries, but the working of the system not being satisfactory, the feed pipes were enlarged and those, and exposed radiating pipes, were covered with asbestos, except at trenches where the former were laid in outer pipes. The boiler-feed supply being deficient for

boilers for searchlight operation, and the completion of the post water system being delayed, a well of several feet diameter was dug to below low-tide level near the power room, walled with stone, and a suction pipe laid in a stone conduit therefrom through the rear traverse. This conduit also serves for cables. The piping for a steam heating system for 6-inch battery was laid and excavation made in rear traverse for a concrete boiler room.

Small work of preservation and repair was also conducted. At the beginning of the fiscal year the middle traverse of the mortar battery had been completed and the right traverse well advanced. During the year the battery construction, electric installation—consisting of wiring, lamps, storage battery, switchboard, and cables from power plant of 10-inch and 12-inch batteries—and a steam heating plant were substantially completed. Steam for the latter is furnished by a 20-horse-power tubular boiler. The rooms of the battery are damp proofed by paper and asphalt over ceilings and under floors and show no leakage. Ceiling I-beams are not exposed; spaces between them are spanned by 6-inch flat hollow tile. Carriages and base parts for the armament pieces were transported to the battery and three base rings set. The railway track from wharf, used during construction, having been removed to permit grading and other improvements of garrison ground, a new track about 2,400 feet long, of good grade, ties, and ballast, and intended for permanent use, was laid from the wharf around the head of the harbor slip and along the northern boundary of the reservation to near the battery. There remain for full completion of this battery setting base rings, placing generating set and additions to switch board in connection with searchlight purposes, introduction of water from the post water system, parapet grading, roadway paving, and some interior finish and other small works.

Dynamite-gun emplacement.—Survey was made of the temporary emplacement and work done on plans for permanent emplacement in early part of the year.

Post lighting system.—Engineer work for the post lighting, consisting of all exterior parts, except lamps at poles, and including switch board in guardhouse and underground cables, was substantially completed. Current is to be supplied from the power plant at the 10-inch and 12-inch batteries, where a booster set and panel for the purpose were placed and wired. The engineer work of the lighting system provided for 25 50-candlepower exterior lamps and 724 16-candlepower interior lamps.

Position-finding stations.—A fire commander's station and three battery commanders' stations of latest approved type for high sites, with earth masks, were partly built. These structures have strong brick walls and concrete floors, heavy enameled-brick interior walls, twisted-steel, concrete and glass-disk roofs, concrete piers, and steel shutters at openings for all-around view of instruments. Two of the stations, as the ground and required height of instruments permitted, are two stories high, the second floors of which are laid with glass disks in concrete. The excavation, drains, foundations, brickwork, instrument platforms, ground floors, and part embankments were built by hired labor; the roofs, shutters, two-vault light floors and lightning conductors are being constructed for $8,105 by the Aberthaw Construction Company, of Boston, the lowest bidder on circular advertisement of ten days' notice, and holder of patent rights in the New

England territory of patented parts of the construction. The contractor was much delayed in obtaining steel; but by the end of the year he had one floor laid and forms erected for roofs and cornices of these stations, and prompt completion of the stations then seemed assured. The lower story of one battery commander's station can serve as shelter room for an intended adjacent searchlight; from the room a passageway with a track leads to a concrete emplacement for the light.

Searchlights.—For use during the coming Army and Navy maneuvers, it was arranged that 7 searchlights, new or old, from 24 to 36 inches in size, were to be borrowed from the defenses of New York Harbor and set up. At the end of the year part of the new projectors and accessory parts shipped, or to be shipped, direct by the manufacturer had been received. Underground cables had been purchased and laid at the longer lines, platforms for the lights partly built, 2 generating sets ordered on written offers after extended inquiry, portable boiler on hand repaired for running one of the sets, and changes made at existing plants for operation of other searchlights.

Money statements.

GUN AND MORTAR BATTERIES.

Two 12-inch and two 10-inch gun emplacements.

July 1, 1901, balance unexpended		$1,718.42
June 30, 1902, amount expended during fiscal year		1,718.42

Three 6-inch gun emplacements.

July 1, 1901, balance unexpended		$2,305.13
June 30, 1902, amount expended during fiscal year		2,305.13

Mortar battery.

July 1, 1901, balance unexpended		$62,730.85
June 30, 1902, amount expended during fiscal year		50,883.51
July 1, 1902, balance unexpended		11,847.34
July 1, 1902, outstanding liabilities	$4,881.54	
July 1, 1902, covered by contract	975.00	
		5,856.54
July 1, 1902, balance available		5,990.80

Dynamite battery.

July 1, 1901, balance unexpended		$62,324.18
June 30, 1902, amount expended during fiscal year	$220.00	
August 26, 1901, deposited to credit of Treasurer, United States	1,104.18	
August 26, 1901, amount withdrawn, in United States Treasury	61,000.00	
		62,324.18

Range-finding stations.

March 7, 1902, amount allotted	$19,200.00
June 30, 1902, amount expended during fiscal year	8,805.81
July 1, 1902, balance unexpended	10,394.19
July 1, 1902, outstanding liabilities	9,452.31
July 1, 1902, balance available	941.88

Searchlights.

March 5, 1902, amount allotted	$450.00	
March 14, 1902, amount allotted	2,000.00	
		$2,450.00
June 30, 1902, amount expended during fiscal year		1,606.66
July 1, 1902, balance unexpended		843.34
July 1, 1902, outstanding liabilities		843.34

GUN AND MORTAR BATTERIES AND SUPPLIES FOR SEACOAST DEFENSES.

Post lighting system.

November 25, 1901, amount allotted	$9,020.00
June 30, 1902, amount expended during fiscal year	7,109.46
July 1, 1902, balance unexpended	1,910.54
July 1, 1902, outstanding liabilities	1,700.67
July 1, 1902, balance available	209.87

PRESERVATION AND REPAIR OF FORTIFICATIONS.

July 1, 1901, balance available	$400.00
December 11, 1901, amount allotted	820.00
	1,220.00
June 30, 1902, amount expended during fiscal year	1,220.00

SEARCHLIGHTS FOR HARBOR DEFENSES.

June 25, 1902, amount allotted	$12,275.00
July 1, 1902, balance available	12,275.00

Contract in force.

Name of contractor: Helios-Upton Company, Philadelphia, Pa.
Date of contract: March 19, 1902.
Work begun: April 5, 1902.
Character of contract: Emergency; for electric accumulators and accessories.
Rates: $975 for all.

SITE NO. 3.

The position-finding station, commenced in the previous year, was completed and transferred to the artillery September 18, 1901. The bank at the near front of this station was heavily riprapped to prevent further wash by the sea; 200 tons of granite were used for the purpose. The location of the fire commander's station was moved back from the bank 17 feet for its safety, as authorized. The heavy concrete foundations for this station and for a battery commander's station, were begun in April, 1902, and laid to within 1 foot of the tops; anchors, shoes, rods, pier tubes, and pipes for wires were built in, and the concrete piers carried to their tops as the towers were erected. The erection of the structural-steel towers and superstructures was let to the Ellicott Machine Company, of Baltimore, on bids received after ten days' notice. On account of delays in obtaining the special steel shapes required the towers were not completed at the end of the year. All the steel was then on the ground, the erection well advanced, and early completion promising. It is expected to put monolithic tops on the foundations after the towers are finished.

One of the batteries, which was built by contract and mainly of natural-cement concrete, leaked badly. The magazines were lined,

one with concrete slabs at the ceiling and hollow tile at the sides, and the other with galvanized sheet steel; these linings have so far served their purpose. The earth filling against the concrete parapet was trenched, the face of the concrete was given two coats of waterproof-cement wash and a 6-inch porous-tile pipe laid at bottom of the trench and extended with vitrified pipe through the filling and to the beach; on top of the porous pipe a broken stone-drain, 2 feet thick, was placed to within about 4 feet of the surface and then covered with tamped earth. Outside of the trench a vitrified pipe was laid to intercept branches from the gutter at the edge of the parapet for carrying surface water to tanks behind end of left traverse. There is no water system at this post, and the small rain-water supply was intended for boiler feed or cooling water for the oil engine at the battery. Much work remains to correct leakage. To prevent or reduce condensation a steam-heating plant was put in at this battery as an experiment; a hoisting-engine boiler on hand was utilized in the plant. After two weeks' test the plant was turned over to the troops in November, 1901. The unavoidable absence of a gravity return from the radiating pipes and the smallness of the boiler's fire box or lack of self-feed are undesirable features of the plant in hands of unskillful or unreliable operators. As a consequence in this case the pipes embedded in concrete froze last winter and burst, requiring tedious repairs.

The parapet of the 10-inch battery was sodded, cobble surface drains laid, and the bank at their outlets heavily faced with stone.

An allotment of funds had been made for a new 6-inch battery. New general plan for the battery was drawn and study made as to suggested modifications. A track was laid from the wharf to the site, part of the excavation made, and materials for construction obtained. Subsequently the site of the battery was changed in a revised project and new plans, adapted thereto, were drawn. A blacksmith shop was built and a track laid to the new site and excavation begun. Shelters in which laborers had been housed were moved to free the location for proposed new barracks.

Sea-wall building, consisting of a heavy bank riprap, was continued; 4,725 tons of granite were placed in the revetment.

In preparation for the summer's Army and Navy maneuvers at this district, a temporary power house in connection with the operation of two 30-inch searchlights was built; steam plant was received from the New York district and set up, and installation of electric generators, storage battery, and switchboards was partly made. The oil engines were tested with a view to the operation by them of 36 and 24 inch projectors. Extensive repairs required by the larger oil engine were made and plans prepared for other betterments to the engine and for ventilation of the engine room.

Money statements.

GUN AND MORTAR BATTERIES.

Battery commander's station, for 12-inch battery.

July 1, 1901, balance unexpended		$5,277.56
June 30, 1902, amount expended during fiscal year	$4,468.06	
October 19, 1901, deposited to credit Treasurer, United States.	809.50	
		5,277.56

Sodding parapet, 10-inch battery.

July 1, 1901, balance unexpended		$500.00
June 30, 1902, amount expended during fiscal year		500.00

Two 6-inch emplacements.

July 1, 1901, balance available		$25,000.00
May 31, 1902, amount withdrawn	$1,700.00	
June 30, 1902, amount expended during fiscal year	2,903.39	
		4,603.39
July 1, 1902, balance unexpended		20,396.61
July 1, 1902, outstanding liabilities		1,288.77
July 1, 1902, balance available		19,107.84

Fire commander's station.

November 26, 1901, amount allotted	$7,960.00
June 30, 1902, amount expended during fiscal year	2,997.84
July 1, 1902, balance unexpended	4,962.16
July 1, 1902, outstanding liabilities	4,654.55
July 1, 1902, balance available	307.61

Battery commander's station, for 10-inch battery.

November 26, 1901, amount allotted	$7,362.00
June 30, 1902, amount expended during fiscal year	2,473.68
July 1, 1902, balance unexpended	4,888.32
July 1, 1902, outstanding liabilities	4,335.08
July 1, 1902, balance available	553.24

Searchlights.

May 12, 1902, amount allotted	$3,840.00
June 30, 1902, amount expended during fiscal year	921.31
July 1, 1902, balance unexpended	2,918.69
July 1, 1902, outstanding liabilities	1,482.29
July 1, 1902, balance available	1,436.40

PRESERVATION AND REPAIR OF FORTIFICATIONS.

July 1, 1901, balance available	$1,900.00
Amount transferred from other works	783.02
	2,683.02
June 30, 1902, amount expended during fiscal year	2,683.02

SEA WALLS AND EMBANKMENTS.

July 1, 1901, balance unexpended	$5,723.78
June 30, 1902, amount expended during fiscal year	5,723.78

SUPPLIES FOR SEACOAST DEFENSES.

July 31, 1901, amount allotted	$500.00
June 30, 1902, amount expended during fiscal year	500.00

SITE NO. 4.

Alterations in the steam plant and small improvements of the drainage at mortar battery were made.

Minor works of repair were conducted at the 10-inch battery.

Foundation of a fire commander's station of latest type for high sites, similar to the new position-finding stations at Site No. 2, was laid; base of pier constructed; brick superstructure built, and grading about the shelter partly made. The twisted-steel, concrete, and glass-disk roof, steel shutters for all-around view of instrument, and lightning conductors are to be provided by the Aberthaw Construction Company, of Boston, under agreement, for $1,809; the contractor has been delayed by difficulty in obtaining his special material.

In preparation for the summer's Army and Navy maneuvers at this district, a temporary power house in connection with the operation of a 30-inch searchlight near fire commander's station was built, and steam plant and generating set received from the New York district were set up. Betterments were made to the steam plant at the mortar battery with reference to operation of a 30-inch projector; pipe lines from the post water main were laid to the 10-inch battery for furnishing water to cooling tank of the oil engine for use in the operation of a 30-inch projector and for other purposes, and a similar line was provided from the well at the mortar battery for oil engine at the 6-inch battery, where a 24-inch searchlight was intended. Two additional searchlights, to be placed at the south end of the reservation with new generating plant, were being arranged for.

Money statements.

GUN AND MORTAR BATTERIES.

Mortar battery.

July 1, 1901, balance unexpended	$252.00
June 30, 1902, amount expended during fiscal year	252.00

Fire commander's station.

March 7, 1902, amount allotted	$4,800.00
June 30, 1902, amount expended during fiscal year	1,293.68
July 1, 1902, balance unexpended	3,506.32
July 1, 1902, outstanding liabilities	2,605.58
July 1, 1902, balance available	900.74

Searchlights.

May 12, 1902, amount allotted	$2,425.00
June 30, 1902, amount expended during fiscal year	247.83
July 1, 1902, balance unexpended	2,177.17
July 1, 1902, outstanding liabilities	837.28
July 1, 1902, balance available	1,339.89

PRESERVATION AND REPAIR OF FORTIFICATIONS.

July 1, 1901, balance available	$150.00
June 30, 1902, amount expended during fiscal year	150.00

SEARCHLIGHTS FOR HARBOR DEFENSES.

June 24, 1902, amount allotted	$7,260.00
July 1, 1902, balance available	7,260.00

SITE NO. 5.

This outwork was cared for by watchmen, who also made some repair. The steam lighter *Panuco*, engaged in transporting riprap for sea wall of the work, was overhauled and repaired. The trestle and track used for moving stone from lighter to place of deposit were rebuilt or repaired where needed and 845 tons of heavy granite put in the sea wall.

Money statements.

GUN AND MORTAR BATTERIES.

July 1, 1901, balance unexpended		$392.11
June 30, 1902, amount expended during fiscal year		346.74
July 1, 1902, balance unexpended		45.37
July 1, 1902, outstanding liabilities		21.00
July 1, 1902, balance available		24.37

PRESERVATION AND REPAIR OF FORTIFICATIONS.

July 1, 1901, balance available		$2,410.00
June 30, 1902, amount expended during fiscal year	$1,590.00	
December 11, 1901, amount withdrawn and reallotted	820.00	
		2,410.00

SEA WALLS AND EMBANKMENTS.

July 1, 1901, balance unexpended		$1,802.12
June 30, 1902, amount expended during fiscal year		1,495.29
July 1, 1902, balance unexpended		306.83
July 1, 1902, outstanding liabilities		128.17
July 1, 1902, balance available		178.66

CARE OF ELECTRIC PLANTS AND OTHER WORK.

During the year an electrician was employed in keeping in repair the several electric plants pertaining to the batteries. From an allotment from the appropriation for "Supplies for Seacoast Defenses," incidental supplies have been furnished for and repairs have been made to the various electric systems and their power plants.

Money statements.

GUN AND MORTAR BATTERIES.

Installation of telautographs, etc.

June 27, 1902, amount allotted	$2,500.00
July 1, 1902, balance unexpended and available	2,500.00

PRESERVATION AND REPAIR OF FORTIFICATIONS.

Salary of electrician.

July 1, 1901, balance available	$900.00
June 30, 1902, amount expended during fiscal year	900.00

Services of expert electrician in artillery district of New London.

June 27, 1902, amount allotted	$1,200.00
July 1, 1902, balance unexpended and available	1,200.00

SUPPLIES FOR SEACOAST DEFENSES.

July 1, 1901, balance unexpended	$615.85
June 30, 1902, amount expended during fiscal year	547.96
July 1, 1902, balance unexpended	67.89
July 1, 1902, outstanding liabilities	37.15
July 1, 1902, balance available	30.74

2 F.

DEFENSES OF NEW YORK HARBOR.

Officer in charge, Maj. William L. Marshall, Corps of Engineers; assistant, Lieut. William L. Guthrie, Corps of Engineers, since March 10, 1902; Division Engineers, Col. Charles R. Suter, Corps of Engineers, until July 24, 1901, and Col. Samuel M. Mansfield, Corps of Engineers, since that date.

DEFENSES AT EASTERN ENTRANCE TO HARBOR.

SITE NO. 1.

At the beginning of the fiscal year a battery for sixteen 12-inch B. L. mortars had been completed and mortars mounted; two emplacements for 5-inch rapid-fire guns had been completed, guns not received; an earth parapet and temporary magazines had been built for the practice battery, where one 8-inch B. L. rifle on altered 15-inch carriage and one 8-inch converted rifle were mounted.

Work of sea-wall construction was in progress.

An electric plant was installed for lighting a mortar battery.

The following work was in progress: Construction of two emplacements for 6-inch rapid-fire guns on pedestal mounts.

During the fiscal year the following work has been done:

Two emplacements for 6-inch rapid-fire guns on pedestal mounts.—These emplacements are practically completed, except installing ammunition hoist, hand rails, and electric wiring. One thousand eight hundred and seventy-one cubic yards of concrete have been put in place, doors were hung and painted, water supply installed, roadway at the rear graded and covered with broken stone, embankment sodded, and inside walls whitened.

The cost of concrete in place in this battery is $7.28 per cubic yard.

Preservation and repair of fortifications.—The ground around the mortar battery has been cleaned up and the old cement shed and engine house removed, the macadam ramps leading to the two westerly pits have been removed and replaced by cement paving, the breaks in the water supply have been repaired, and the walls along the two northern pits and along the ramp have been given a coating of Portland-cement plaster.

Sea walls and embankments.—Under allotment of $10,000 made for the purpose, the construction of a sea wall on the north shore of the island was begun to protect the caving earth banks between rocky points. The wall is to be built of rubble masonry laid in cement mortar, and is to be capped by a coping course at a height of 14 feet at mean low water. The work has been continued, and 375 linear feet without riprap protection has been built.

Money statements.

GUN AND MORTAR BATTERIES.

July 1, 1901, balance unexpended	$27,650.00
June 30, 1902, amount expended during fiscal year	17,601.60
July 1, 1902, balance unexpended	10,048.40
July 1, 1902, outstanding liabilities	963.42
July 1, 1902, balance available	9,084.98

PRESERVATION AND REPAIR OF FORTIFICATIONS.

July 1, 1901, balance unexpended	$520.15
June 30, 1902, amount expended during fiscal year	259.78
July 1, 1902, balance unexpended	260.37
July 1, 1902, outstanding liabilities	260.37

SEAWALLS AND EMBANKMENTS.

July 1, 1901, balance unexpended	$9,825.00
June 30, 1902, amount expended during fiscal year	5,124.88
July 1, 1902, balance unexpended	4,700.12
July 1, 1902, outstanding liabilities	283.75
July 1, 1902, balance available	4,416.37

Pay of civilian electrician.

Allotted during fiscal year	$1,200.00
July 1, 1902, balance unexpended and available	1,200.00

SITE NO. 2.

These works consist of an old stone fort and outlying batteries, with modern batteries.

At the beginning of the fiscal year the battery of two 10-inch guns on disappearing carriages had been completed and armed; two emplacements for 12-inch guns had been completed and armed; two emplacements for 15-pounder rapid-fire guns had been completed and guns mounted; two emplacements for 5-inch rapid-fire guns had been completed, but not armed; an electric-light plant had been installed in one of the casemates of the stone fort and connected with the completed emplacements; two range-finder stations, type A, had been constructed; and an electric tide indicator for the range-finder stations had been installed and turned over to the commanding officer.

During the fiscal year the following work was done:

The repairs to 5-inch and 3-inch and to 12-inch emplacement No. 2, damaged by storm of November 24, 1901, were completed; the slope wall in front of 5-inch battery, about 420 square feet, has been relaid, and the earth replaced and sodded. At the 3-inch battery about 50 cubic yards of earth have been replaced in the embankment and sodded. In front of 12-inch emplacement No. 2 the slope wall, 1,200 feet, was relaid.

The 5-inch guns were received and mounted.

Sea walls and embankments.—Work on sea-wall construction was continued during the fiscal year.

Two hundred and sixty-six linear feet of wall have been constructed on the north shore, without any filling behind or riprap in front.

Seven hundred and forty-eight linear feet of wall have been built on the south shore, back of the hospital, extending from above the railroad trestle to the causeway. About one-half of the riprap protection and one-tenth of the filling has been placed.

The elevation between the hospital and the railroad track was leveled off and the material used as filling.

At the foot of slope of 12-inch emplacement No. 1, the sea wall, damaged by storm of November 24, 1901, was raised for about 50 linear feet, and the earth replaced behind it.

In front of 12-inch emplacement No. 2, the sea wall, which was badly broken up for a distance of 80 linear feet, was rebuilt, and on the west side of this emplacement the upper half of the wall was rebuilt for a distance of 120 feet. Two hundred and eighty linear feet of wall were rebuilt along north side of the parade ground and protected by riprap on exposed face.

Preservation and repair of fortifications.—All magazines, rooms, etc., of the different emplacements have been whitewashed.

Repairs have been made to ammunition hoist of the 10-inch battery.

A new drainage outlet has been made for the platform of 12-inch emplacement No. 1, through the granite wall on the west side of the battery, and a new drain laid along the rear of this platform.

All the crevices in platform and crest of the 10-inch and 12-inch batteries have been filled with Callahan's cement.

The main drain through the old fort has been repaired and a new wall built around the manhole, near the 3-inch battery.

The implement racks have been set in 10 and 12 inch batteries.

Money statements.

GUN AND MORTAR BATTERIES.

Allotted during fiscal year	$1,200.00
June 30, 1902, amount expended during fiscal year	557.44
July 1, 1902, balance unexpended and available	642.56

SEA WALLS ANE EMBANKMENTS.

July 1, 1901, balance unexpended	$15,320.01
Allotted since	4,600.00
	19,920.01
June 30, 1902, amount expended during fiscal year	13,265.80
July 1, 1902, balance unexpended	6,654.21
July 1, 1902, outstanding liabilities	1,381.79
July 1, 1902, balance available	5,272.43

PRESERVATION AND REPAIR OF FORTIFICATIONS.

July 1, 1901, balance unexpended	$1,648.27
June 30, 1902, amount expended during fiscal year	551.01
July 1, 1902, balance unexpended	1,097.26
July 1, 1902, outstanding liabilities	91.50
July 1, 1902, balance available	1,005.76

SITE NO. 3.

These fortifications consist of an old casemated stone fort with old batteries and modern defenses.

At the beginning of the fiscal year a mortar battery, containing eight

positions for 12-inch B. L. mortars, had been completed and armed; at the gun battery (6 emplacements for disappearing guns), two 12-inch, two 10-inch, and two 8-inch emplacements had been completed and armed; two emplacements for 5-inch and two for 3-inch rapid-fire guns had been completed and armed; an electric-lighting plant, with underground conduits for connections, had been installed, and a mining casemate had been built and turned over to the commanding officer.

During the past fiscal year the following work was done:

Range-finder stations.—Construction of four range-finder shelters was authorized by the Chief of Engineers. Work was begun in March, 1902; the parapet for the mortar battery, for foundation of these stations, has been excavated; forms have been erected in part; and ironwork and some other material has been partly received. On May 28, 1902, a report was submitted to the Chief of Engineers for consideration of a change in the location of the stations and with his authority, dated June 3, 1902, work was suspended, pending action of the Chief of Artillery.

Torpedoes for harbor defense.—By authority of the Chief of Engineers an extension of a shed to the laboratory, for storage battery, has been built of brick, 30 by 30 feet, on the south end of the building, on the same level as the lower floor, one story high, with cement floor, tin roof, and ceiled overhead inside.

An Armington-Sims engine was repaired; new center bearing put under the boiler, consisting of a brick pier, capped with iron plates and roller bearing; and a new inspirator was put on.

Magazines in the old stone fort were connected by cable with dynamo casemate for better illumination.

Additions to mining casemate are practically completed, with exception of some minor details on inside doors and windows.

Addition to building, School of Submarine Defense.—Work on additions to museum building is in progress; about 900 cubic yards of earth has been excavated and spread in bank, and 100 linear feet of 8-inch drain has been laid.

Preservation and repair of fortifications.—At the beginning of the fiscal year the grass slopes were in a bad condition from neglect. They were all mowed and cleaned and are greatly improved.

Repairs to macadamized roadway were completed and the road well drained.

The pavement in rear of emplacement No. 5 of the gun battery had settled; it has been cut out and new pavement put in place.

The tunnel was badly washed and the earth from the quartermaster's road had washed in and stopped up the main catch basins constructed. Four hundred and forty linear feet of 12-inch drain tile were laid.

The whole roadway on both sides of the ordnance storehouse has been remodeled, the embankments have been sodded to prevent wash, and 440 feet of cobble gutter has been laid along roadway.

A water supply was put into the mining casemate.

The engineer wharf, which was damaged by the storm of November 24, 1901, has been repaired.

Two pieces of hand rail have been placed in rear of the ammunition lifts, to prevent shot truck from rolling down the bank.

The old road along the sea wall, between mining casemate and elec-

trical laboratory, has been raised, graded, and covered with a light coat of macadam, and banks have been sodded.

All doors have been painted, and all but a few of the implement racks have been placed.

Money statements.

GUN AND MORTAR BATTERIES.

July 1, 1901, balance unexpended		$1,160.10
Allotted since		14,000.00
		15,160.10
June 30, 1902, amount expended during fiscal year		3,102.39
July 1, 1902, balance unexpended		12,057.71
July 1, 1902, outstanding liabilities	$588.78	
July 1, 1902, amount covered by uncompleted contracts	2,652.00	
		3,240.78
July 1, 1902, balance available		8,816.93

TORPEDOES FOR HARBOR DEFENSE.

Allotted during the fiscal year	$6,500.00
June 30, 1902, amount expended during fiscal year	4,800.06
July 1, 1902, balance unexpended	1,699.94
July 1, 1902, outstanding liabilities	689.22
July 1, 1902, balance available	1,010.72

BUILDING, SCHOOL OF SUBMARINE DEFENSE.

Allotted during the fiscal year	$11,750.00
July 1, 1902, outstanding liabilities	390.71
July 1, 1902, balance available	11,359.29

PRESERVATION AND REPAIR OF FORTIFICATIONS.

July 1, 1901, balance unexpended	$608.73
Allotted during fiscal year	1,558.00
	2,166.73
June 30, 1902, amount expended during fiscal year	1,974.49
July 1, 1902, balance unexpended	192.24
July 1, 1902, outstanding liabilities	37.50
July 1, 1902, balance available	154.74

DEFENSES ON ISLANDS IN HARBOR.

Fort Columbus, Castle Williams, and South Battery.—No modern works of defense are at this point, and no work was done during the fiscal year ending June 30, 1901.

The sum of $5,000 is available from appropriation for "Preservation and Repair of Fortifications," act of June 6, 1902, to be applied to necessary repairs and preservation of old Fort Columbus.

Money statement.

Allotted during the fiscal year	$5,000.00
July 1, 1902, balance unexpended and available	5,000.00

Sea wall at Governors Island, New York Harbor.—This wall, completed in 1893, incloses the entire island. It is in good condition.

During the past fiscal year an allotment of $1,000 was available for repairs to the sea wall between the main landing and the ordnance dock. These repairs were completed at a cost of $325.

Money statement.

SEA WALLS AND EMBANKMENTS.

Allotted during the fiscal year	$1,000.00
June 30, 1902, amount expended during the fiscal year	325.00
July 1, 1902, balance unexpended and available	675.00

Fort Lafayette, New York.—This work is situated on Hendricks shoal, in the Narrows, New York Harbor, about 1,000 feet from the Long Island shore. The area inclosed by a sea wall is about 270 feet square.

The fort is a circular casemated structure in three tiers, built of Newark red sandstone founded on riprap. It was injured by fire in 1868, since which time it has been abandoned as a work of defense.

Fort Wood.—The fortifications consist of a stone fort and outer earthen batteries. No work was done upon the fortifications during the fiscal year ending June 30, 1901.

Sea wall at Bedloes Island, New York Harbor.—This island was partly inclosed by a sea wall extending from the north point of the island around to the eastward and bordering the whole island, except about 700 feet on the northwest side.

Allotment for building a sea wall to cover this gap, and for making embankment behind it, was made from the appropriation for "Sea Walls and Embankments," act of March 1, 1901.

Under contract, the sea wall has been built along half-tide line, and the embankment is nearly finished.

An allotment of $20,000 was made May 6, 1901, for the purpose of building a sea wall on the west shore of Bedloes Island, New York Harbor, and filling behind it with embankment. The proposed sea wall was to connect the wall at the north point of the island with that on the southwest side, completing the inclosing of the island; it was to be located at about half-tide level, and was to be about 714 feet long.

Under date of July 6, 1901, a contract was entered into with Mr. Harry L. Smith, of Long Island City, N. Y., to build about 714 linear feet of sea wall, at $10.75 per foot, and to place 11,500 cubic yards, more or less, of embankment, at 28 cents per yard for such material as the contractor was required to furnish and 10 cents per yard for material on the island furnished by the United States.

The contractor began delivering materials and building the wall in August, 1901. Under extension of contract, the sea wall was completed in April, 1902. It is 723 feet long; is built of rubble granite, closely laid in cement mortar; is 3 feet wide at the top, which is 8.4 feet above mean low water, and 4 feet wide at the bottom, resting on a foundation of the same class of work 5 feet wide and 1 foot thick. The embankment is not yet completed. About 6,500 cubic yards of material have been placed in it, and it is estimated that 500 yards more are required.

A small amount of riprap has been laid along the base of the wall to protect it from undermining.

The available funds will be ample to complete the embankment and put in such riprap as may be needed for security, and it is proposed to apply them to that end.

Contracts in force.

Name of contractor: Harry L. Smith, 240 Purdy street, Long Island City, N. Y.
Date of contract: July 6, 1901.
Date of approval: July 18, 1901.
Date of completion: January 19, 1902.

A reasonable extension of time for completion of contract has been granted, no specific date having been set.

Money statement.

July 1, 1901, balance unexpended		$19,967.51
June 30, 1902, amount expended during fiscal year	$8,979.59	
Amount withdrawn and reallotted	5,600.00	
		14,579.59
July 1, 1902, balance unexpended		5,387.92
July 1, 1902, outstanding liabilities	$1,075.79	
July 1, 1902, amount covered by uncompleted contracts	1,397.66	
		2,473.45
July 1, 1902, balance available		2,914.47

DEFENSES ON LONG ISLAND.

These fortifications consist of an old casemated stone fort and outlying batteries, all to be replaced by modern batteries.

At the beginning of the fiscal year the following emplacements and auxiliary works had been completed:

Battery of seven 10-inch guns on disappearing carriages; battery of four 12-inch guns, two on barbette and two on disappearing carriages; battery of eight 12-inch B. L. mortars; battery of two 4.7-inch rapid-fire guns; battery of two 3-inch rapid-fire guns complete, except setting base castings; two battery commander, stations for the 10-inch battery; and one electric tide indicator, installed on the quartermaster's wharf and connected with the range-finder stations.

The following work was in progress:

Construction of a battery for two 12-inch and two 6-inch guns on disappearing carriages; erection of a fire commander's station; installation of central electric-power plant, and construction of two battery commanders' stations.

During the fiscal year the following work has been done:

Two emplacements for 12-inch B. L. rifles on disappearing carriages and two emplacements for 6-inch rapid-fire guns on disappearing carriages.—This battery was completed. Two hundred and ten cubic yards of concrete were put in place and 377 square yards of pavement were laid. Exterior and rear slopes of parapet were graded and sodded, brick gutters were laid in ditch, ammunition hoists and cranes were installed, trolley system for conveying projectiles was erected, hand rails and implement racks were erected, electric lights were installed, and doors and shutters were constructed and hung. One 6-inch disappearing carriage and gun was mounted in emplacement

No. 2, and two 12-inch disappearing carriages and guns were mounted in emplacements No. 3 and No. 4.

Carriage and gun for emplacement No. 1 have not yet been received.

Four emplacements for 6-inch rapid-fire guns on pedestal mounts.—Work was begun in August, 1901; 986 cubic yards of obstructing masonry were removed; 1,499 cubic yards of material were excavated; 2,870 cubic yards of concrete were put in place, and 1,026 square yards of pavement were laid. The platforms are ready for mounts. These emplacements are nearly completed. There remains only a small quantity of concrete to be placed and the grading and sodding of exterior and rear slopes to be done, the road in ditch to be made, and the plant and old material to be removed.

Range-finder stations.—One fire commander's station was completed and turned over to the commanding officer October 15, 1901.

Battery commander's station (steel tower) for 12-inch battery and battery commander's station (steel tower) for the mortar battery were completed and turned over to the commanding officer November 30, 1901.

Under an allotment of $100 two temporary concrete platforms for 2.24-inch rapid-fire guns were constructed in rear of emplacement No. 1 of the 10-inch battery.

Installation of central electric light and power plant.—The project consisted in the installation of two direct-connected engines and generating sets of 37½ and 62½ kilowatt capacity at 110 volts, each to be supplied by an independent steam boiler, and three sets of storage batteries with switchboards, a brick power house, and lead-covered insulated cables laid in vitrified conduits.

The construction of the plant has been completed, and it has been in operation since April, 1902, supplying light for all the batteries daily during drill.

Torpedo casemate, etc.—A torpedo casemate and cable gallery, constructed under allotment from appropriation for "Torpedoes for Harbor Defense," were turned over to the artillery May 6, 1901. No work has been done during the past fiscal year.

Preservation and repair of fortifications.—Under the various allotments from this appropriation the following work was done during the fiscal year:

At the 10-inch battery seven double and five single iron doors were made and hung, to replace warped wooden doors.

Iron lintels were placed over the outside doors of the 10-inch and 12-inch batteries.

At the 10-inch, 12-inch, and mortar batteries steel implement racks were placed on all loading platforms; plates showing names of batteries and numbers of emplacements were attached to the outside walls; exterior and rear slopes were repaired and resodded, and brick gutters and drains were repaired.

Contracts in force.

For American Portland cement, "Atlas" brand:
Name of contractor: Atlas Portland Cement Company, 30 Broad street, New York, N. Y.
Date of contract: June 27, 1901.
Date of approval: July 12, 1901.
Quantity: Five thousand barrels, at $1.50 per barrel, in 4 sacks, less 10 cents for each empty sack returned, or $1.10 net.

For broken trap rock, 1½-inch gauge:
Name of contractor: Manhattan Trap Rock Company, 11 Broadway, New York, N. Y.
Date of contract: June 27, 1901.
Date of approval: July 18, 1901.
Quantity: Three thousand five hundred cubic yards, at 72 cents per cubic yard.

Money statements.

GUN AND MORTAR BATTERIES.

Battery construction.

July 1, 1901, balance unexpended		$73,670.99
Allotted since		250.00
		73,920.99
June 30, 1902, amount expended during fiscal year	$46,637.56	
Amount withdrawn and reallotted	600.00	
		47,237.56
July 1, 1902, balance unexpended		26,683.43
July 1, 1902, outstanding liabilities	4,566.85	
July 1, 1902, amount covered by uncompleted contracts	2,706.59	
		7,273.44
July 1, 1902, balance available		19,409.99

Electric plant.

July 1, 1901, balance unexpended	$27,534.60
June 30, 1902, amount expended during fiscal year	27,534.60

SEARCHLIGHTS, NEW YORK HARBOR.

July 1, 1901, balance unexpended	$11,500.00
June 30, 1902, amount expended during fiscal year	11,497.40
July 1, 1902, balance unexpeneded	2.60
July 1, 1902, outstanding liabilities	2.60

PRESERVATION AND REPAIR OF FORTIFICATIONS.

July 1, 1901, balance unexpended	$3,207.26
June 30, 1902, amount expended during fiscal year	2,168.20
July 1, 1902, balance unexpended	1,039.06
July 1, 1902, outstanding liabilities	578.19
July 1, 1902, balance available	460.87

Pay of civilian electrician, steam engineers, and stokers.

Amount allotted during fiscal year	$7,020.00
June 30, 1902, amount expended during fiscal year	300.00
July 1, 1902, balance unexpended	6,720.00
July 1, 1902, outstanding liabilities	400.00
July 1, 1902, balance available	6,320.00

DEFENSES ON STATEN ISLAND.

These fortifications consist of two old casemate stone forts and outlying batteries with modern defenses.

At the beginning of the fiscal year a mining casemate, torpedo-storage building, and three cable tanks were constructed and equipped

with machinery for handling material. The following batteries and emplacements had been completed and armed:

A 5-gun battery for 8-inch rifles; two batteries, each for two 10-inch rifles, with electric-lighting plant, and range-finder shelters; a battery for two 12-inch guns on disappearing carriages, with electric plant; a battery for two 12-inch guns on disappearing carriages; two emplacements for 6-inch rapid-fire guns; two emplacements for 4.7-inch rapid-fire guns; two emplacements for 8-inch B. L. rifles on modified 15-inch gun carriage; two emplacements for 6-inch rapid-fire guns on disappearing carriages; two emplacements for 3-inch rapid-fire guns, armament not yet received.

The following work was in progress:

Construction of a battery for two 12-inch guns on disappearing carriages.

During the fiscal year the following work has been done:

Battery for two 12-inch guns on disappearing carriages.—This battery was completed. Three thousand five hundred and thirty-nine cubic yards of concrete were put in place. Exterior and rear slopes of parapet were graded and sodded; ammunition hoists, and electric motors for operating same, and cranes were installed; trolley system for conveying projectiles was erected; hand rails and implement racks were erected; electric lights were installed, and doors and shutters were hung.

The guns and carriages are on hand and are being mounted.

New battery for two 12-inch guns on disappearing carriages, model 1901.—Under an allotment of $100,000 excavation for foundation of these emplacements was begun September 14, 1901. Thirty-six thousand nine hundred and thirty-six cubic yards of material were excavated and placed in parapet at a cost of 17 cents per cubic yard. The concrete work has been completed to the height of ceiling beams, and 4,340 cubic yards of concrete were put in place at a cost of $4.69 per cubic yard.

Installation of central electric light and power plant.—The project consisted of two direct-connected engines and generating sets of 37½ and 80 kilowatts capacity at 110 volts, each to be supplied by an independent steam boiler, two sets of storage batteries with switchboards, a brick power house, and lead-covered insulated cables laid in vitrified conduits.

The construction of the plant has been completed and is ready for transfer to the artillery.

Peace storage magazine.—Under allotments of $10,000 work of construction was begun in April, 1902. The brick work of building is completed, roof truss is placed, and floor beams laid. The building is nearly ready to receive the roof.

Other work.—Under an allotment of $3,200, electric motors for operation of ammunition hoists in two batteries were installed.

Under an allotment of $1,400, 3 structures for datum points were built.

Under an allotment of $465, implement racks have been installed in the various batteries.

Under an allotment of $1,500, 13 telephone booths were installed.

At the old stone fort the construction of 4 concrete pedestals for range-finder stations was completed.

Steel doors and shutters were installed in all range-finder stations.

An allotment of $2,150 was made during June, 1902, for the engineer work of installing the telautograph system. The necessary cable was ordered.

Two 12-inch and two 6-inch rapid-fire guns on disappearing carriages were mounted.

Preservation and repair of fortifications.—Under the several allotments from this appropriation the following work was done during the fiscal year: Removing arch at south cliff battery; repairs to steps, 6-inch rapid-fire guns, in same battery; repairs to windows and painting doors; constructing new bridge at entrance to old stone fort; painting roofs and magazines; installation of water-supply systems; installation of concrete pedestals for bases of Lewis position finders in four batteries; paving drain in road, and establishing permanent granite bench marks in rear of the several emplacements.

All modern emplacements have been serially numbered.

Sites for fortifications and seacoast defenses.—Condemnation proceedings had been instituted for the acquisition of additional land as site for fortifications. By authority of the Secretary of War, this property was purchased for the sum of $38,000 October 4, 1901, and jurisdiction over it was ceded by the State of New York to the United States December 19, 1901.

Contracts in force.

For American Portland cement, Saylors brand:
Name of contractor: Commercial Wood and Cement Co.
Date of contract: April 15, 1902.
Date of approval by the Chief of Engineers: April 28, 1902.
Approximate amount: 10,000 barrels, at $1.47 per barrel, in bags, four bags to the barrel, with a rebate of 7 cents per bag for each empty bag returned; to be completed December 31, 1902.

For broken trap rock:
Name of contractor: Jacob E. Conklin.
Date of contract: April 12, 1902.
Date of approval by the Chief of Engineers: April 26, 1902.
Approximate amount: 8,000 cubic yards, at 84 cents per cubic yard, measured in scows; to be completed December 31, 1902.

Emergency contract for furnishing steel doors, shutters, gratings, and cast-iron flue covers for 12-inch battery:
Name of contractor: Julius Jonson.
Date of contract: June 6, 1902.
Total consideration of contract: $1,879.
Date of completion: August 15, 1902.

Money statements.

GUN AND MORTAR BATTTERIES.

July 1, 1901, balance unexpended		$40,717.53
Allotted since		117,250.00
		157,967.53
June 30, 1902, amount expended during fiscal year	$86,649.68	
June 30, 1902, amount deposited to credit of appropriation	130.15	
		86,779.83
July 1, 1902, balance unexpended		$71,187.70
July 1, 1902, outstanding liabilities	$17,604.64	
July 1, 1902, amount covered by uncompleted contracts	10,824.00	
		28,428.64
July 1, 1902, balance available		42,759.06

Electric plant.

July 1, 1901, balance unexpended	$19,544.98
June 30, 1902, amount expended during fiscal year	19,544.98

SEARCHLIGHTS FOR NEW YORK HARBOR.

July 1, 1901, balance unexpended	$20,633.67
June 30, 1902, amount expended during fiscal year	20,633.67

SUPPLIES FOR SEACOAST DEFENSES.

Allotted during fiscal year	$3,200.00
June 30, 1902, amount expended during fiscal year	3,200.00

SITES FOR FORTIFICATIONS AND SEACOAST DEFENSES.

July 1, 1901, balance unexpended		$19,997.90
Allotted since		18,100.00
		38,097.90
June 30, 1902, amount expended during fiscal year	$38,002.10	
October 6, 1901, amount deposited to credit of appropriation	95.80	
		38,097.90

PRESERVATION AND REPAIR OF FORTIFICATIONS.

July 1, 1901, balance unexpended	$2,418.67
Allotted since	1,044.00
	3,462.67
June 30, 1902, amount expended during fiscal year	2,453.87
July 1, 1902, balance unexpended	8.80
July 1, 1902, outstanding liabilities	8.80

DEFENSES AT SANDY HOOK.

This fortification, on the south side of the main entrance to New York Harbor, consists of an old casemated stone fort with modern batteries.

At the beginning of the fiscal year a mining casemate, storage building, and four cable tanks were built; a mortar battery for sixteen 12-inch mortars was completed; gun-lift battery No. 1, for two 12-inch guns, was completed and armed; battery of two emplacements for 10-inch guns was completed and guns mounted; battery of three emplacements for 10-inch and four emplacements for 12-inch guns was completed and guns mounted; one emplacement for 5-inch rapid-fire gun was completed and gun mounted; the pneumatic dynamite-gun battery, containing one 8-inch and two 15-inch dynamite guns, was completed with parapet and magazines and guns mounted; temporary emplacements for one 5-inch siege rifle, one 7-inch siege howitzer, and one 4.7-inch rapid-fire gun were built and guns mounted; four emplacements for 3-inch rapid-fire guns had been built as far as practicable, awaiting delivery of base castings and mounts; three range-finder towers had been built, and two independent searchlight plants had been installed.

The following work was done during the fiscal year:

Two emplacements for 6-inch rapid-fire guns on pedestal mounts.—Work was begun July 11, 1901. Location was graded and pits for foundation excavated and a railway was laid from concrete plant near dynamite-gun battery, 1,200 feet, to location. Concrete was hauled from mixer to battery by cable cars. Derricks were placed at each end of battery to facilitate handling of materials. Great care was taken to secure dry rooms by the use of a mixture of alum and soap in all vertical surfaces, and over ceiling beams a finished mortar course was laid and allowed to dry before laying four courses of asbes-

tos waterproof paper, each shingled 8 inches and painted down, after which 1 inch of low-grade mortar was spread and concrete layers continued. A covering of asphalt was laid in the floor layers to prevent dampness arising through floor. Concrete work was completed during November, 1901, consisting of 1,864 cubic yards of concrete in place, at a cost of $9.06 per cubic yard.

Two emplacements for 12-inch guns, model 1901, on disappearing carriages.—The foundations up to bottom of floor were laid before the winter of 1901; concrete plant was removed from dynamite-gun battery to the location of the emplacements during February and March; trestle, stone, and sand bins and cement shed were removed and rebuilt; hoisting and mixer engines were set up; four well points were driven and connected with steam pump, and engine house was built. Tracks were laid on which the concrete cars are handled by cable. Three derricks move the concrete from cars to position.

Concrete work is being carried on and 4,000 cubic yards are in place, at a cost of $6.02 per cubic yard. Steel beams have been delivered and doors contracted for.

Installation of electric light and power plant.—Work was begun in July, 1901. The project consisted in installing a central electric plant, primarily for searchlights and incidentally for lighting emplacements, and providing power for operation of guns, viz, two direct-connected steam engines and generating sets of 37½ and 80 kilowatts capacity at 110 volts, each set to be supplied by an independent steam boiler; storage battery with switchboard, and a brick power house, and lead-covered insulated cable laid in vitrified conduits, near the batteries, elsewhere buried in trenches.

A brick building has been constructed, and engines, boilers, etc., are installed and ready for use.

The plant is supplied with fresh water from eight driven well points running to low-water level. Water is drawn by a Worthington duplex steam pump and jet condenser, which, when required, will condense the exhaust.

Switchboard has been set up and connected with dynamos. A storage-battery room was built at east end of power house and a 64-cell chloride accumulator, type G 19, set up therein, and connected with switchboard. Nineteen thousand nine hundred and forty-one feet of lead-covered insulated cable has been purchased and nearly all laid between the power house and each battery; separate cables for light, for power, and for searchlight stations were laid.

Total cost of entire plant to date, $52,612.89.

Preservation and repair of fortifications.—Drifting sand, covering the areas in rear of batteries and the ditch of the mortar battery, caused considerable trouble and expense as well as inconvenience and unsightliness.

An allotment of $2,530 was made by the Chief of Engineers, and the Quartermaster's Department authorized the expenditure of $2,000 for grading these areas and covering them with cinders to prevent the sand from drifting.

Between July and December, 1901, the areas were covered with 3 inches of cinders.

The batteries are greatly improved in appearance and no complaints have been made of sand drifting around the guns.

The range-finder towers have had larger top plates put on the concrete pedestals, the old plates having been too small for modern range finders.

One instrument room was built; ladders were placed to the roofs of range finders, and projecting flanges of one were removed.

Iron ventilating doors were put at the entrance to the storage-battery rooms.

Waterproofing was done at gun-lift battery and another battery. Cracks between stones around guns of gun lift were cut out and joints filled with waterproof cement; the leaks were entirely stopped.

The cracks in loading platform of emplacement No. 2 of the two 10-inch gun battery were cut out and filled with waterproof cement, and so far the leaks, which were serious, have been stopped.

New fire brick were put in the fire boxes of boilers in gun-lift battery.

The railroad tracks were removed along the wharf and joined with main line; the tracks now use only the outer end of the wharf, approaching on the made ground on the northwest side. The tracks to all batteries have been kept in repair.

The pneumatic dynamite-gun battery has been dismantled.

Sea wall, north shore.—The work done to the beginning of the fiscal year consisted in building 157 linear feet of wall on continuation of sea wall, north shore.

During the fiscal year the sea wall on the north shore and the rip-rap wall, east shore, were completed, making the entire north wall 480 linear feet long; and a jetty was built near the dynamite-gun battery. The work was completed in August, 1901. Total cost, $2,975.44.

Contracts in force.

American Portland cement, "Lehigh" brand:
Name of contractor: Hiram Snyder & Co., 229 Broadway, New York City.
Date of contract: April 14, 1902.
Date of approval: April 26, 1902.
Quantity: Five thousand barrels, at $1.63 per barrel, in 4 sacks, less 10 cents for each empty sack returned, or $1.23 net.

Broken trap rock, 1½ inch gauge:
Name of contractor: Jacob E. Conklin, 135 Front street, New York City.
Date of contract: April 12, 1902.
Date of approval: April 26, 1902.
Quantity: Four thousand cubic yards, at 89 cents per cubic yard.

Money statements.

GUN AND MORTAR BATTERIES.

July 1, 1901, balance unexpended		$35,589.12
Allotted since		100,000.00
Received from sale of coal		45.98
		135,585.10
Amount withdrawn and reallotted	$600.00	
Amount deposited to credit of appropriation	2,774.93	
June 30, 1902, amount expended during fiscal year	63,473.28	
		66,848.21
July 1, 1902, balance unexpended		68,736.89
July 1, 1902, outstanding liabilities	$9,276.73	
July 1, 1902, amount covered by uncompleted contracts	7,231.38	
		16,508.11
July 1, 1902, balance available		52,228.78

Electric plant.

July 1, 1901, balance unexpended	$10,000.00
June 30, 1902, amount expended during fiscal year	10,000.00

SEARCHLIGHTS, NEW YORK HARBOR.

July 1, 1901, balance unexpended	$45,700.00
June 30, 1902, amount expended during fiscal year	42,612.89
July 1, 1902, balance unexpended	3,087.11
July 1, 1902, outstanding liabilities	681.15
July 1, 1902, balance available	2,405.96

TORPEDOES FOR HARBOR DEFENSE.

Allotted during the fiscal year	$152.00
June 30, 1902, amount expended during fiscal year	[illegible]50.69
	20.69

SEA WALLS AND EMBANKMENTS.

Sea wall, north shore

July 1, 1901, balance	$0.70
July 1, 1902, balance unexpended	.70
July 1, 1902, outstanding liabilities	.70

Emplacements for two 3-inch rapid-fire guns.—An allotment of $16,000 for this battery was made June 28, 1900, and work began September 1, 1900. At the end of the last fiscal year the battery had been completed in all details except a part of the embankment. During the fiscal year the available balance was expended in completing the earth embankment, removing railroad construction tracks and trolley lines, grading a roadway to the wharf, and in cleaning, painting, and storing the working plant. The battery was turned over to the artillery September 16, 1901. No guns or carriages have been received. Wells were left in the platforms of sufficient size for embedding the base castings in the concrete when they arrive.

Money statements.

MAIN BATTERY.

July 1, 1901, balance unexpended	$47.72
July 1, 1902, balance unexpended	47.72
July 1, 1902, outstanding liabilities	47.72

15-POUNDER RAPID-FIRE BATTERY, LEFT FLANK OF 4.72-INCH RAPID-FIRE BATTERY.

July 1, 1901, balance unexpended	$2,172.63
June 30, 1902, amount expended during the fiscal year	2,172.63
Previously expended	13,827.37
Total expenditure	16,000.00

Battery commanders' stations.—Allotments of $5,700 and $5,600 were made September 26, 1900, for the construction of stations for the battery for three 12-inch guns and for the mortar battery, respectively. Both stations are of the typical design for low sites. Construction work began in November, 1900, and at the beginning of the present fiscal year the foundations had been constructed, the framework and the inner and outer cylinders of each station had been assembled to the floors of the instrument rooms, and the inner cylin-

ders had been filled with concrete. Work was continued during the present fiscal year with frequent delays on account of the parts not fitting together properly. The stations were completed in all details in October, 1901. They were turned over to the artillery on May 26, 1902.

On February 1, 1902, allotments of $160 and $135 were made from the appropriation for "Gun and Mortar Batteries," act of July 7, 1898, for connecting, in underground conduit, the battery commander's station for the 12-inch battery and that for the mortar battery, respectively, with the fire-control telephone systems. For the 12-inch station connections were made to the temporary fire-control system, the permanent location of the telephone booths not being fixed. Permanent connections will be made when the permanent booths are constructed. The work for the mortar-battery station was completed.

Battery commander's station for 10-inch battery.—An allotment of $6,600 was made October 19, 1901, for the construction of this station. This station is of the typical design for low sites. Proposals for furnishing and delivering the tower complete, ready for erection, were opened March 25, 1902. The only proposal received ($5,500) was considered excessive and rejected. Under modified specifications proposals for furnishing and delivering the metal work only, ready for erection, were opened May 19, 1902, and a contract was awarded to the lowest bidder, the New Jersey Foundry and Machine Company, of New York, for the sum of $5,250, delivery to be made on or before October 1, 1902. An additional allotment of $1,700 was made May 22, 1902, to cover the increased cost of materials. The concrete foundations were completed in May, 1902.

Money statements.

September 26, 1900, amount allotted	$11,300.00
Amount expended up to June 30, 1901	3,866.35
July 1, 1901, balance unexpended	7,433.65
June 30, 1902, amount expended during the fiscal year	7,433.65

ELECTRICAL CONNECTIONS.

February 1, 1902, amount allotted	$160.00
February 1, 1902, amount allotted	135.00
	295.00
June 30, 1902, amount expended during the fiscal year	266.89
July 1, 1902, balance unexpended	28.11
July 1, 1902, outstanding liabilities	15.00
July 1, 1902, balance available	13.11

BATTERY COMMANDER'S STATION.

October 19, 1901, amount allotted	$6,600.00
May 22, 1902, amount allotted	1,700.00
	8,300.00
June 30, 1902, amount expended during the fiscal year	1,525.59
July 1, 1902, balance unexpended	6,774.41
July 1, 1902, amount covered by existing contracts	5,250.00
July 1, 1902, balance available	1,524.41

Stations for Rafferty range finders.—The construction of these stations was authorized by the Chief of Engineers June 7, 1901, the cost

to be paid from the allotment for two 3-inch emplacements. The sites were practically completed at the end of the last fiscal year. (See Annual Report of Chief of Engineers for 1901, p. 782.) The stations were completed in July, 1901, and under date of August 13, 1901, an allotment of $161.36 was made from the appropriation for "Gun and Mortar Batteries," act of May 25, 1900, to cover the cost of the work. The amount expended from the allotment for two 3-inch emplacements was credited to that allotment.

Money statement.

August 13, 1901, amount allotted	$161.36
June 30, 1902, amount expended during the fiscal year	161.36

Preservation and repair of submarine mining material.—At the end of the last fiscal year the material had been inspected and put in good condition. It was transferred to the artillery July 13, 1901.

During the last fiscal year, under an allotment of $1,500, dated January 16, 1901, from the appropriation for "Preservation and Repair of Fortifications," act of May 25, 1900, the cable tank was being lined with steel sheets to make it water-tight. At the end of the fiscal year the sheets had been riveted together ready for lowering into the tank. During the present fiscal year the steel lining was lowered into the tank, calked water-tight, and the space around the outside filled with concrete, 43 cubic yards being required. This work was completed in July, 1901.

Money statement.

July 1, 1901, balance unexpended	$2.62
June 30, 1902, amount expended during the fiscal year	2.62

Preservation and repair of fortifications.—Necessary repairs were made at various times to river banks, wharves, sea walls, sluice gates, and the earthen slopes of batteries at each reservation. Engines, boilers, locomotives, and pumps were cleaned and painted, and, together with cars, mixers, tools, etc., stored. A miscellaneous lot of unserviceable property and a large quantity of old iron were condemned and destroyed or sold at public auction.

Repairs were made to the drainage system of a part of the barbette of one of the masonry works of old type. Rammer and stave supports of steel angles were placed in one battery for 12-inch guns. Pavements were completed in the entrance galleries of the 4.7-inch rapid-fire battery, which were repaired during the last fiscal year. (See Annual Report of the Chief of Engineers for 1901, p. 777.)

At the 10-inch and 12-inch battery six hoisting cranes, which were obstructed by the bracketed galleries connecting the platforms, were moved to the opposite side of the platforms, and the trolley rails for ammunition service extended to them; guards were placed over the gearing of the electric winches of the ammunition hoists, an automatic hydraulic pump was put in the boiler pit of the electric plant, and the platform waterproofed with linseed oil.

At the battery of two 12-inch and two 8-inch guns twelve steel doors were repaired where they had rusted through. On April 19, 1902, the sum of $280 was allotted for the purchase and erection of steel doors to replace the wooden doors of the four telephone booths and for repairs to the steel doors over the stairways and ammunition hoists. The doors had not been purchased at the end of the fiscal year.

At the mortar battery repairs were made to 615 square feet of the interior face walls where they had scaled. The terminal boxes of the

firing circuits were set back in the walls and mortared in solid. Under an allotment of $160, dated April 30, 1902, the drainage of the pits under the mortars was improved by raising the bottoms about 3 inches and by placing check valves on the drains at their outlets into the main drain.

Paints and other miscellaneous materials were supplied to the artillery at the different posts on approved requisitions.

Money statement.

July 1, 1901, balance unexpended	$5,733.71
Amount allotted during fiscal year	930.00
	6,663.71
June 30, 1902, amount expended during fiscal year	6,057.46
July 1, 1902, balance unexpended	606.25
July 1, 1902, outstanding liabilities	4.24
July 1, 1902, balance available	602.01

But one contract for fortification work was in force at the end of the fiscal year, as follows:

Contract in force during the fiscal year.

Name of contractor: New Jersey Foundry and Machine Company, of New York.

Date of contract: May 27, 1902.

For furnishing and delivering alongside the Government wharf, on or before October 1, 1902, the materials for the metal work required in the construction of a steel tower, for the sum of $5,250. Emergency contract.

Supplies for seacoast defenses.—Miscellaneous materials called for on requisitions of acting engineer officers, duly approved by the Chief of Engineers, were purchased and turned over to them.

An allotment of $1,705 was made by the Chief of Engineers from the appropriation for "Supplies for Seacoast Defenses," act of March 1, 1901, to be applied to the installation of electric lights for night drills on the platforms of emplacements for six 12-inch, two 8-inch, four 3-inch rapid-fire guns, and sixteen 12-inch B. L. mortars. This work was begun on September 11, 1901, and completed on December 28, 1901.

From the mains of the post water supply, 800 feet of 2-inch pipe were laid for supplying one electric plant; also 50 feet of 1½-inch pipe were laid for supplying the mortar battery.

A lead-lined sink, with lead-pipe drain to sewer, was constructed in one storage-battery room.

Extensive repairs were made to the boiler of an electric plant injured by the corrosive action of the water in use. Heavy linoleum was placed on the floor of the dynamo room in this same battery.

Repairs of various kinds were made to the electric plants.

Money statement.

July 1, 1901, balance unexpended	$1,343.44
November 30, 1901, amount allotted	500.00
January 11, 1902, amount allotted	500.00
August 13, 1901, amount received for materials purchased and returned to dealers	1.29
	2,344.73
June 30, 1902, amount expended during fiscal year	2,221.32
July 1, 1902, balance unexpended	123.41

2 H.

DEFENSES OF BALTIMORE, MARYLAND.

Officer in charge, Lieut. Col. Oswald H. Ernst, Corps of Engineers, until July 31, 1901, and Col. Peter C. Hains, Corps of Engineers, since that date.

Fort McHenry, Md.—This is used for garrison purposes and is not in the system of defense. No expenditures were made in the fiscal year.

SITE NO. 1.

Emplacements for one 12-inch and three 8-inch B. L. rifles on disappearing carriages.—This battery was complete and guns mounted, but the magazines and galleries were damp from seepage and condensation. A system of metal ceiling and drainage was partially installed during the year, which work is still in progress.

Money statement.

PRESERVATION AND REPAIR OF FORTIFICATIONS AND GUN AND MORTAR BATTERIES.

October 21, 1901, transferred from other allotments	$5,608.57
June 30, 1902, amount expended during fiscal year	4,967.21
July 1, 1902, balance unexpended	641.36
July 1, 1902, outstanding liabilities	499.96
July 1, 1902, balance available	141.40

Emplacements for two 4.7-inch rapid-fire guns on pedestal mounts.—This battery was complete and guns mounted.

Emplacements for two 3-inch rapid-fire guns on balanced-pillar mounts.—This battery was complete and guns mounted.

Mining casemate.—At the beginning of the fiscal year the excavations had been made and the concrete had been brought up to the height of the roof beams. The operations of the year have consisted in completing the work.

Money statement.

TORPEDOES FOR HARBOR DEFENSE.

July 1, 1901, balance unexpended	$4,599.03
October 5, 1901, allotted	402.29
October 24, 1901, allotted	800.00
June 30, 1902, amount expended during fiscal year	5,801.32

Coal storage.—The project was to enlarge the existing coal bin in rear of the 12-inch emplacement and cover it with a roof. At the beginning of the fiscal year partial excavation had been made, and during the year this was completed, the enlargement made, the roof put on, and the work finished.

Money statement.

SUPPLIES FOR SEACOAST DEFENSES.

mo.	
Oc., 1901, balance unexpended	$1,375.00
rial, a', 1902, amount expended during fiscal year	1,375.00

Sea walls and embankments.—This reservation is protected from the encroachments of the Patapsco River by a rubble sea wall. Washouts had threatened the stability of the wall, and a project was commenced in 1901 to put a light concrete backing behind it. At the beginning of the fiscal year 1,200 linear feet of the backing had been placed and 400 linear feet have been placed since, thus completing the project.

Money statement.

July 1, 1901, balance unexpended	$1,685.98
June 30, 1902, amount expended during fiscal year	1,685.98

Sites for fortifications and seacoast defenses.—The project was to make a survey of this reservation and vicinity and to procure copies of State records relating to land in the vicinity. The survey was made and the records procured during the year.

Money statement.

December 3, 1901, allotted	$155.55
June 30, 1902, amount expended during fiscal year	155.55

Preservation and repair of fortifications.—With funds from this appropriation, the batteries, electric lighting and power plants, the wharf, and the sea wall were kept in repair during the year.

Money statement.

July 1, 1901, balance unexpended	$1,531.87
October 21, 1901, amount transferred to another allotment	147.46
April 7, 1902, amount transferred to another allotment	500.00
June 30, 1902, amount expended during fiscal year	884.41
	1,531.87

SITE NO. 2.

Emplacements for two 12-inch B. L. rifles on nondisappearing carriages.—These and their armament were complete.

Emplacements for two 5-inch rapid-fire guns on balanced-pillar mounts.—The emplacements were complete, one carriage mounted, and the other partially so. The top of one carriage was mounted by the garrison during the year, and this battery is now complete with the exception of the guns.

Emplacements for two 3-inch rapid-fire guns on balanced-pillar mounts.—These were complete, with their armament.

Remodeling old work.—The top of the old wall was finished off with cement mortar, the flashings around the top walls over the casemates on fronts 3 and 4, where the asphalt roof extends, were filled with cement mortar, and two places broken in the top of the granite wall on front 3 were filled and dressed up, thus finishing the work.

Money statement.

GUN AND MORTAR BATTERIES.

July 1, 1901, balance unexpended	$2,238.97
June 30, 1902, amount expended during fiscal year	2,238.97

Battery commander's station.—During the year the masonry excavation was made, the foundations built up, all the ironwork erected and the tower nearly completed.

	4.78
	21.32
	123.41

Money statement.

GUN AND MORTAR BATTERIES.

November 12, 1901, allotted		$6,000.00
June 30, 1902, amount expended during fiscal year		5,544.32
July 1, 1902, balance unexpended		455.68
July 1, 1902, outstanding liabilities		226.94
July 1, 1902, balance available		228.74

Preservation and repair of fortifications.—The batteries, the electric light and power plant, the old masonry work, and the wharf have been kept in repair during the year with funds from this appropriation.

Money statement.

July 1, 1901, balance unexpended		$1,242.94
October 31, 1901, transferred to another allotment	$1,000.00	
June 30, 1902, amount expended during fiscal year	242.94	
		1,242.94

SITE NO. 3.

Battery for eight 12-inch B. L. mortars.—This was complete with its armament, but the rooms and galleries were wet. In 1901 experimental damp proofing was commenced, and during the present fiscal year a system of metal ceiling combined with gutters, drains, and ventilation has been partially installed, which is of a less tentative nature. Care has been taken to feel the way cautiously and observe results, and this method causes slow progress. It is expected that the damp proofing will soon be completed.

Money statement.

July 1, 1901, balance unexpended		$12,282.55
October 21, 1901, transferred to another allotment	$2,500.00	
June 30, 1902, amount expended during fiscal year	8,575.30	
		11,075.38
July 1, 1902, balance unexpended		1,207.17
July 1, 1902, outstanding liabilities		512.32
July 1, 1902, balance available		694.85

Emplacements for two 12-inch B. L. rifles on disappearing carriages.—This battery with its armament was complete.

Emplacements for two 5-inch rapid-fire guns on balanced-pillar mounts.—The emplacements were complete and carriages mounted; guns were on hand, but not mounted.

Emplacements for two 3-inch rapid-fire guns on balanced-pillar mounts.—The emplacements were complete, but there are no guns or mounts.

Emplacements for two 6-inch B. L. rifles on disappearing carriages.—The emplacements were complete and carriages mounted; no guns on hand.

Emplacements for two 3-inch rapid-fire guns on balanced-pillar mounts.—The emplacements were complete, but are without armament.

Other works.—A mining casemate, a storehouse for torpedo material, and a cable tank were completed.

Sea walls and embankments.—At the beginning of the fiscal year the rubble wall had received a concrete backing and the fill had been partially placed behind the concrete wall. During the year a riprap foundation for the extension of the wall westward to the limits of the reservation was placed, the fill behind the concrete and rubble wall was completed, and several washouts in the fill and breaks in the rubble wall were repaired. During high winds it was found that the sea breaking in over the wall caused serious washouts for a distance of about 25 feet behind the wall, threatening its stability, the saline water also killing the ordinary sod. Accordingly, a salt swamp sod was placed for that distance behind about half the length of the wall, and that work is still in progress at the close of the fiscal year.

Money statement.

July 1, 1901, balance unexpended	$15,067.92
June 30, 1902, amount expended during fiscal year	14,102.82
July 1, 1902, balance unexpended	965.10
July 1, 1902, outstanding liabilities	847.25
July 1, 1902, balance available	117.85

Roadway.—The project was to build a road between the eastern 3-inch battery and the 12-inch battery to connect the system of roadways on the part of the reservation reserved for defenses. The roadway was all constructed during the fiscal year.

Money statement.

GUN AND MORTAR BATTERIES.

July 1, 1901, balance unexpended	$3,316.50
June 30, 1902, amount expended during fiscal year	3,316.50

Raising bases for two Rafferty range finders.—There were already concrete bases for the range finders, but these were abandoned during the fiscal year and structural-iron bases were constructed at a higher elevation on the mortar battery.

Money statement.

GUN AND MORTAR BATTERIES.

January 22, 1902, allotted	$200.00
June 30, 1902, amount expended during fiscal year	200.00

Two battery commanders' stations.—The work of constructing these towers was commenced in October, 1901, and the foundations were ready in the following January, but much delay was encountered in the delivery of the ironwork. At the close of the fiscal year the instrument columns, the shields, and the frameworks had been erected, and it is expected to complete the stations by the end of July.

Money statement.

October 31, 1901, allotted	$14,600.00
June 30, 1902, amount expended during fiscal year	6,241.61
July 1, 1902, balance unexpended	8,358.39
July 1, 1902, outstanding liabilities	6,108.11
July 1, 1902, balance available	2,250.28

Electrician expert.—An electrician expert was supplied the garrison since March 31, 1902, in connection with the submarine-mine defense.

Money statement.

PRESERVATION AND REPAIR OF FORTIFICATIONS.

March 5, 1902, allotted		$450.00
June 27, 1902, allotted		1,200.00
		1,650.00
June 30, 1902, amount expended during fiscal year		75.00
July 1, 1902, balance unexpended		1,575.00
July 1, 1902, outstanding liabilities		75.00
July 1, 1902, balance available		1,500.00

Preservation and repair of fortifications.—The batteries, mining casemate, storehouses, cable tank, and electric light and power plants were kept in repair during the year with funds from this appropriation.

Money statement.

July 1, 1901, balance unexpended		$2,400.00
April 7, 1902, transferred from another allotment		500.00
		2,900.00
October 21, 1901, transferred to another allotment	$1,500.00	
June 30, 1902, amount expended during fiscal year	921.23	
		2,421.23
July 1, 1902, balance unexpended		478.77
July 1, 1902, outstanding liabilities		478.77

SITE NO. 4.

Emplacements for two 6-inch B. L. rifles on disappearing carriages.—These were complete with their carriages at the beginning of the fiscal year with the exception of wiring and electric plant, which is to be deferred until the whole project for defense is in process of construction. The guns are on hand, but not mounted.

Sea walls and embankments.—At the beginning of the fiscal year the concrete wall was completed, but the fill behind it was only partially made. During the year the fill was finished and a strip of salt swamp sod 8 feet wide placed behind the wall to prevent washouts by the break of the sea over the wall.

Money statement.

July 1, 1901, balance unexpended		$3,000.00
June 30, 1902, amount expended during fiscal year		3,000.00

Preservation and repair of fortifications.—The battery and property on this reservation have been kept in repair during the year with funds from this appropriation.

Money statement.

July 1, 1901, balance unexpended		$536.11
October 21, 1901, transferred to another allotment	$461.11	
June 30, 1902, amount expended during fiscal year	75.00	
		536.11

Supplies for seacoast defenses.—Electrical supplies for all the electric installations pertaining to the defenses of Baltimore, Md., have been furnished the artillery during the year, on requisitions approved by the Chief of Engineers.

Money statement.

July 1, 1901, balance unexpended		$1,002.65
Allotted during fiscal year		363.04
		1,365.69
June 30, 1902, amount expended during fiscal year		1,345.22
July 1, 1902, balance unexpended and available		20.47

2 I.

DEFENSES OF WASHINGTON, DISTRICT OF COLUMBIA.

Officer in charge, Lieut. Col. Charles J. Allen, Corps of Engineers. Officers in charge of Fort Foote Military Reservation, Md., Lieut. Col. Charles J. Allen, Corps of Engineers, until December 4, 1901, and Maj. William M. Black, Corps of Engineers, since that date.

Fort Foote, Potomac River, Maryland.—Under instructions of November 30, 1901, the military reservation of Fort Foote, Md., was placed under the charge of the commanding officer of the Engineer School of Application at Washington Barracks, D. C.

Some minor repairs to the wharf, consisting of replacing 7 dock piles and binding the same, and replacing some of the deck planking, have been made at the close of the year, at an expense of $50.

No other work was carried on during the year except the usual care by the ordnance sergeant stationed at the fort.

Additional minor repairs are needed to the wharf and the road leading to the same.

Money statement.

PRESERVATION AND REPAIR OF FORTIFICATIONS.

December 5, 1901, amount received by transfer		$50.00
June 30, 1902, amount expended to end of fiscal year	$22.00	
July 1, 1902, outstanding liabilities	28.00	
		50.00

LEFT BANK POTOMAC RIVER.

The progress and general condition of the work at the close of the fiscal year ended June 30, 1899, were as follows:

A battery for two 10-inch guns on disappearing carriages, L. F., model of 1894, was completed by the close of 1896. The guns were mounted in the winter of 1896–97. During the fiscal year ended June 30, 1899, an electric-light plant was installed in this battery.

A second battery for two 10-inch guns was completed and had an electric-light and power plant installed in it. One of the guns was mounted in 1897 on a disappearing carriage, L. F., model of 1894; the other was mounted in May, 1898, on a disappearing carriage, L. F., model of 1896.

A third battery for two 10-inch guns was also completed. The guns were mounted in 1898 on disappearing carriages, model of 1896. This battery was commenced in the latter part of March, 1898, and built with funds from the appropriation of March 9, 1898, for "National Defense."

Emplacements for two 4-inch Driggs-Schroeder rapid-fire guns were also completed. The guns were mounted by the early part of July, 1898.

These three 10-inch gun batteries and the 4-inch rapid-fire gun battery were turned over to the officer of artillery commanding the post on July 6, 1899, in accordance with paragraph 1486, Army Regulations, 1895.

The following work has been carried on during the past fiscal year:

Mortar battery for eight 12-inch mortars on carriages, model of 1896.—Work on this battery was commenced August 25, 1898. At the close of the fiscal year 1901 the battery was about 97 per cent completed. During the past fiscal year an electric-light plant was installed under contract with W. M. Sheehan, of New York; the erection of trolleys was finished, and the other small items of work necessary to complete the battery were done. The carriages were received and mounted by the artillery. The mortars were received and seven of them mounted, also by the artillery. The battery is completed and in condition to be turned over to the officer of artillery commanding the post.

Money statement.

July 1, 1901, balance unexpended	$8,520.86
June 30, 1902, amount expended during fiscal year	8,504.16
July 1, 1902, balance unexpended	16.70
July 1, 1902, outstanding liabilities	16.70

ALLOTMENTS.

Gun and mortar batteries:	
August 8, 1898, act of May 7, 1898	$113,000
March 11, 1901, act of May 25, 1900	4,000
	117,000

Battery for two 6-inch rapid-fire guns on disappearing carriages.—This work was commenced in June, 1899. At the close of the fiscal year 1901 this battery was 92 per cent completed. During the fiscal year an electric conduit leading from the mortar battery was constructed and an electric-light plant installed—the latter work being done under contract with W. M. Sheehan, of New York. The power for operating the plant is obtained from the central generating plant at one of the 10-inch batteries. Trolley beams were installed, roadway and gutters finished, and the battery cleaned up. The work is completed and in condition to be turned over to the officer of artillery commanding the post. The carriages are mounted; the guns were received in June, 1902, and are to be mounted by the artillery.

Money statement.

July 1, 1901, balance unexpended	$6,130.41
June 30, 1902, amount expended during fiscal year	6,118.57
July 1, 1902, balance unexpended	11.84
July 1, 1902, outstanding liabilities	11.84

ALLOTMENTS.

Gun and mortar batteries:	
April 26, 1899, act of May 7, 1898	$59,180.00
June 21, 1901, act of March 1, 1901	5,450.00
	64,630.00

Battery for two 3-inch rapid-fire guns.—An allotment of $9,500 was made December 28, 1898, for emplacements for two 3-inch rapid-fire guns. By October, 1899, the work was practically completed excepting the construction of the gun platforms, which can not advantageously be undertaken until the gun mounts arrive.

Money statement.

July 1, 1901, balance unexpended	$1,850.09
June 30, 1902, amount expended during fiscal year	754.08
July 1, 1902, balance unexpended	1,096.01
July 1, 1902, outstanding liabilities	43.00
July 1, 1902, balance available	1,053.01

Battery commanders' stations.—Under allotments of June 17 and 29, 1899, aggregating $12,206, work was commenced in September, 1899, on three stations. All the stations were turned over to the artillery officer commanding the post August 29, 1901.

Money statement.

July 1, 1901, balance unexpended	$3,358.35
June 30, 1902, amount expended during fiscal year	3,188.74
July 1, 1902, balance deposited in Treasury of the United States	169.61

Elevated rear passageways, 10-inch batteries.—The project contemplated connecting the gun platforms of each battery together and with their observing station with a platform of the same elevation under an allotment of $2,600, dated February 25, 1901. Both works were completed.

Money statement.

July 1, 1901, balance unexpended	$1,756.59
June 30, 1902, amount expended during fiscal year	1,756.59

Supplies for seacoast defenses.—Under allotments of $250, October 21, 1901, and $105, May 23, 1902, a quantity of supplies of various kinds was purchased and issued to the coast artillery of this district, in accordance with the provisions of General Orders, No. 66, Adjutant-General's Office, 1900. The boiler of electric plant at one of the 10-inch batteries was also put in order.

Money statement.

July 1, 1901, balance unexpended	$205.49
Allotments during the year	355.00
	560.49
June 30, 1902, amount expended during fiscal year	454.60
July 1, 1902, balance unexpended	105.89
July 1, 1902, outstanding liabilities	105.89

Preservation and repair of fortifications.—During the fiscal year repairs have been made as follows: To the north and south ammunition lifts of one of the 10-inch batteries, including new gear wheels and brackets; to the parapet of another 10-inch battery; to the superior slope of south emplacement of a third 10-inch battery; and to electrical plant. Grass and weeds were cut about the batteries and slopes were seeded and the usual cleaning and sanitary work done.

Money statement.

July 1, 1901, balance unexpended	$1,393.99
Allotment and transfer during the year	310.00
	1,703.99
June 30, 1902, amount expended during fiscal year	1,579.63
July 1, 1902, balance unexpended	124.36
July 1, 1902, outstanding liabilities	14.36
July 1, 1902, balance available	110.00

ALLOTMENTS.

Preservation and repair of fortifications:	
June 11, 1900, act of May 25, 1900	$875.00
May 20, 1901, act of March 1, 1901	1,225.00
October 22, 1901, act of March 1, 1901 (by transfer from another work)	200.00
June 21, 1902, act of June 6, 1902	110.00
	2,410.00

All the work at this locality during the fiscal year ending June 30, 1902, was done by hired labor, excepting installation of electric plants, which was done under contract with W. M. Sheehan, of New York.

Contracts in force during fiscal year.

Name of contractor: W. M. Sheehan, of New York, N.Y., for furnishing and installing electric-light plant in the mortar battery.
Date of contract: September 21,1901.
Date of approval: October 7, 1901.
Date for completion, within forty-five days from date of commencement. The contractor was allowed a reasonable additional time for completion of the work.
Amount of contract: $4,718.

Name of contractor: W. M. Sheehan, of New York, N. Y., for furnishing and installing electric-light plant in the 6-inch battery.
Date of contract: October 8, 1901.
Date of approval: October 28, 1901.
Date for completion, within seventy-five days from date of commencement, exclusive of Sundays and legal holidays. The contractor was allowed a reasonable additional time for completion of the work.
Amount of contract, $2,895.

RIGHT BANK POTOMAC RIVER.

Emplacements for three 8-inch guns on disappearing carriages L. F., model of 1894.—This battery was built by contract dated December 16, 1896, with Douglas & Andrews, of Baltimore, Md., under the provisions of the act of Congress of June 6, 1896, providing for the construction of fortifications by contract, to be paid for as appropriations might be made from time to time therefor.

An allotment of $100,000, to be expended under the contract, was made March 27, 1897. The contract work was finally completed August 15, 1898.

The guns were mounted and ready for service by April 1, 1898.

The battery was formally turned over to the commanding officer of the post on January 13, 1900.

During the fiscal year an electric-light and power plant was installed in this battery, and which will be noted further on.

Emplacements for two 5-inch rapid-fire guns.—Under an allotment of $14,500, October 4, 1898, for constructing two emplacements for 5-inch rapid-fire guns on balanced-pillar mounts, work was begun in November, 1898. A further allotment of $2,700 was made February 7, 1901.

The two emplacements are entirely separated. Both batteries were practically finished by June 30, 1901.

The work of the fiscal year consisted of the erection of the railing and general care of the batteries. The guns have been received and one of them has been mounted by the artillery.

Money statement.

July 1, 1901, balance unexpended	$568.37
June 30, 1902, amount expended during fiscal year	540.90
July 1, 1902, balance unexpended	27.47
July 1, 1902, outstanding liabilities	27.47

Battery for three 3-inch rapid-fire guns.—An allotment of $15,100 was made June 25, 1900, to be applied to the construction of emplacements for three 3-inch rapid-fire guns, in accordance with plans submitted.

Materials were purchased and the work of construction commenced in August, 1900. At the close of the fiscal year 1901 about 60 per cent of the concrete had been laid and the entire work of construction was about one-half done.

During the past fiscal year the parapets and earth embankments were built and the drainage system completed. The platforms were about half finished, the remaining work on them being deferred until the mounts shall have been received.

Money statement.

July 1, 1901, balance unexpended	$5,411.64
June 30, 1902, amount expended during fiscal year	5,099.13
July 1, 1902, balance unexpended and available	312.51

Electric-light and power plant.—Work on the construction of a power house and installation of an electric-light and power plant was commenced November 7, 1898. By the end of the fiscal year 1899 the the cistern and power house were built in so far as they could be done before installation of the plant, and this was their condition as to progress at the close of the fiscal year 1901.

During the year 1902 the cistern and the building for housing the engine, boiler, and dynamo were completed and the electric-light and power plant installed. An aerial pole line was also erected for use in lighting the post, all the electrical work being done under contract with W. M. Sheehan, of New York.

Money statement.

July 1, 1901, balance unexpended	$10,145.45
June 30, 1902, amount expended during fiscal year	10,144.92
July 1, 1902, balance unexpended	.53
July 1, 1902, outstanding liabilities	.53

ALLOTMENTS.

October 7, 1898, gun and mortar batteries:	
Act of March 27, 1897	$4,732.93
Act of May 7, 1898	4,300.00
June 26, 1901, "Gun and Mortar Batteries:"	
Act of March 1, 1901	4,800.00
	13,832.93

Battery commander's station.—Under an allotment of $4,259, July 29, 1899, for the construction of a high-type station near the 8-inch battery for mounting a type A range finder, construction work was commenced October 5 of that year. By June 30, 1901, the station was practically completed. The only work that remained to be done was some painting of wood and iron work, construction of a little brickwork, and some fitting of windows. This was all finished in July, and the station was turned over to the artillery August 26,1901.

Money statement.

July 1, 1901, balance unexpended	$1,803.96
June 30, 1902, amount expended during fiscal year	1,803.96

Elevated passage to connect gun platforms, 8-inch battery.—An allotment of $1,485 was made January 16, 1901, for this work. Construction work was commenced in June, 1901, and at the end of that month concrete piers and footings for columns had been built and the columns and some floor beams erected. Some drilling and cutting of old concrete to receive the beams had been done and some excavations made. The entire work was about 25 per cent completed.

During the past fiscal year all the concrete work was done and the railing and stairs erected, the work being entirely completed in September, 1901.

Money statement.

July 1, 1901, balance unexpended	$1,016.75
June 30, 1902, amount expended during fiscal year	1,016.75

Preservation and repair of fortifications.—The work of the past fiscal year was as follows: At the 8-inch battery repairs were made to doors, ammunition lifts, and brackets, and to concrete of superior slope of battery, middle traverse, and some broken mouthpieces were replaced.

The other batteries were cared for and cleaned up; a new stack was built for searchlight plant; coal tubs, derricks, and other parts of working plant were painted; spikes and projections on wharf-fender piles were removed to avoid injury to boats in landing; grass and weeds were cut around engineer office and quarters and the 3-inch battery; searchlight was tested and cared for; a light was maintained on the wharf, and the usual sanitary work was done.

Money statement.

July 1, 1901, balance unexpended	$755.99
Allotment during year	110.00
	865.99
June 30, 1902, amount expended during fiscal year	[a]671.46
July 1, 1902, balance unexpended	194.53
July 1, 1902, outstanding liabilities	84.53
July 1, 1902, balance available	110.00

[a] Of this amount $200 was transferred to work on the left bank of the Potomac.

ALLOTMENTS.

Preservation and repair of fortifications:	
June 11, 1900, act of May 25, 1900	$900.00
May 20, 1901, act of March 1, 1901	725.00
June 21, 1902, act of June 6, 1902	110.00
	1,735.00

All the work at this locality, during the fiscal year ending June 30, 1902, was done by hired labor, excepting installation of electric-light and power plant, which was done under contract with W. M. Sheehan, of New York.

Contract in force during the fiscal year.

Name of contractor: W. M. Sheehan, of New York, N. Y., for furnishing and installing electric-light and power plant in the 8-inch battery.
Date of contract: October 8, 1901.
Date of approval: October 25, 1901.
Date for commencement: November 15, 1901.
Date for completion: Within ninety days from date of commencement. The contractor was allowed a reasonable additional time for completion of the work.
Amount of contract: $8,975.

2 J.

DEFENSES OF HAMPTON ROADS, VIRGINIA.

Officer in charge, Maj. James B. Quinn, Corps of Engineers; Division Engineer, Col. Peter C. Hains, Corps of Engineers.

NORTH SIDE OF CHANNEL.

Emplacement for 10-inch gun in bastion.—This emplacement is located within the main work, was constructed with funds allotted from the appropriation for "Gun and Mortar Batteries," act of July 7, 1898, and is now completed, with the exception of providing sources for supplying the current to charge the electric-storage battery for lighting purposes, which has been set up, but the acid mixture has not been put in the cells on account of the absence of means for charging the same, although the cable conductors have been laid. The plant from which the current is to be furnished will be completed in the fiscal year 1903.

During the fiscal year 1902 iron hoods were placed over all doors and windows of the emplacement, the ammunition hoist cleaned and painted, washouts in slope repaired, and drain pipe from counterweight well run to foot of slope to prevent recurrence of washouts.

Under the authority dated April 8, 1902, the sum of $277.28 was expended from the allotment for this emplacement in building two platforms for the two 2.24-inch Driggs-Schroeder rapid-fire guns supplied for saluting purposes. The platforms were built on the barbette tier of the main work, and for which a total of 19 cubic yards of concrete was required.

Money statement.

July 1, 1901, balance unexpended	$4,266.24
June 30, 1902, amount expended during fiscal year	1,112.59
July 1, 1902, balance unexpended	3,153.65
July 1, 1902, outstanding liabilities	4.50
July 1, 1902, balance available	3,149.15

ALLOTMENT.

Appropriation for "Gun and Mortar Batteries," act July 7, 1898..... $38,000.00

Emplacements for three 12-inch guns.—The work at this battery in the fiscal year consisted in putting in a system of speaking tubes—a line extending from each platform to the relocator room—erecting railings for loading platforms, and laying pipe for water connection to each emplacement. In the rear of the battery a wall 2 feet wide, with top reference 8 feet above mean low water, was built up from mean low water with granite rubblestone. The length of this wall is 483 feet, behind which 702 cubic yards of sand were used to make the fill to the top of the structure. Shelves for relocator rooms and implement racks for shot galleries were provided, hoods over all openings were put up and painted, concrete cut out for chain ammunition hoists and telephone booths, and such work as whitewashing rooms, repairs to cars and other plant done.

All the carriages and guns have been mounted, and as soon as the lifts are replaced by chain ammunition hoists, the emplacements will be transferred to the Artillery Corps.

Money statement.

July 1, 1901, balance unexpended		$19,780.93
June 30, 1902, expended during fiscal year	$7,895.43	
June 30, 1902, withdrawn during fiscal year	7,275.00	
		15,170.43
July 1, 1902, balance unexpended		4,610.50
July 1, 1902, outstanding liabilities		227.19
July 1, 1902, balance available		4,383.31

ALLOTMENT.

Appropriation for "Gun and Mortar Batteries," act May 7, 1898.... $150,000.00

Emplacements for two 12-inch guns.—This work has been advanced as far as practicable during the fiscal year, and the foundation is now undergoing test for stability. The greatest subsidence, so far observed, is only 0.045 feet.

The work during the fiscal year included the driving of 720 linear feet of double-lap sheet piling to prevent undermining of the foundation during severe storms, grading the site to 6 feet above mean low water, at which reference the concrete foundation was started, and it has been carried up to 9.9 feet above the datum plane, requiring 2,135 cubic yards of concrete. The weight of the beams, angles, and bolts embedded therein was 272,468 pounds.

Owing to the soft character of the strata underlying this battery site at a depth of about 25 feet below mean low water, a test loading of the foundation, to remain for six months, was thought advisable

prior to continuing construction above foundation reference, as it was feared some settlement might take place when all the weight to be borne by the foundation was upon it. To make this test, 4,593 cubic yards of sand were placed over the entire site, being held in place by sheathing. Three rods were set prior to placing the sand, and the original elevations were taken December 31, 1901. The subsidence observed to June 30, 1902, is as stated above.

The surface in close proximity to the rear of the battery has been brought up to 10 feet above mean low water by filling with sand; the quantity placed amounting to 981 cubic yards.

In addition to the above, the construction plant to serve in building the emplacements has been installed; positive drain pipes have been laid from each counterweight well; repairs have been made to plant; material has been unloaded, hauled to the site, and stored, and a 40-foot railroad-track scale of 50 tons capacity was purchased and set up.

Proposals for constructing the riprap sea wall for the protection of the battery were opened September 6, 1901, but the lowest being considered excessive, all were rejected. It is now proposed to demolish the water battery and to use the stone therefrom in the sea wall, the balance of the material to be purchased under proposals which were opened April 17, 1902.

Money statement.

July 1, 1901, balance unexpended		$187,325.11
June 30, 1902, expended during fiscal year	$31,097.83	
June 30, 1902, withdrawn during fiscal year	12,165.00	
		43,262.83
July 1, 1902, balance unexpended and available		144,062.28

ALLOTMENTS.

Appropriation for "Gun and Mortar Batteries:"	
Act May 25, 1900	$125,500.00
Act March 1, 1901	63,000.00
	188,500.00

Abstract of contracts in force.

Name of contractor: B. Wallis & Co.
Date of approval: September 5, 1901.
Rates: For steel I-beams, $2\frac{7}{6}$ cents per pound; connection plates, bolts, and washers, 4 cents per pound, and connection bolts, nuts, and washers for beam flanges, 4 cents per pound.
Material to be delivered within thirty days from September 8, 1901 (time limit waived).
Date of expiration: October 28, 1901.

Name of contractor: McClenahan Granite Company.
Date of approval: September 6, 1901.
Rates: 2-inch broken stone, $1.58 per cubic yard; 1-inch broken stone, $1.58 per cubic yard.
Date of delivery: 500 cubic yards, each size, within thirty days from September 18, 1901, and the balance at the rate of 500 cubic yards of each size stone per month.
Date of expiration: December 27, 1901.

Name of contractor: Virginia Portland Cement Company.
Date of approval: September 16, 1901.
Rate: $1.40 per barrel.
Date of delivery: 1,500 barrels within thirty days from September 18, 1901, and the balance as called for.
Date of expiration: December 31, 1901.

Emplacements for two 6-inch rapid-fire guns.—This battery was authorized September 24, 1901, the estimated cost being $24,000. In arrangement of rooms and ammunition service it departs from the type plans.

Before the foundation could be put in, a fill, requiring 1,780 cubic yards of sand, was made over the site, after which the sheathing for the concrete was erected. At the close of the fiscal year 180 cubic yards of concrete had been mixed and rammed in position, and 1,500 cubic yards of sand placed for the sand cover. A wall 2 feet high, of rubblestone, to protect the toe of the exterior slope from the wash of storm tides has been built for a distance of 383 feet.

Money statement.

July 1, 1901, balance unexpended		$30,000.00
June 30, 1902, expended during fiscal year	$2,613.49	
June 30, 1902, withdrawn during fiscal year	6,000.00	
		8,613.49
July 1, 1902, balance unexpended		21,386.51
July 1, 1902, outstanding liabilities	186.13	
July 1, 1902, amount covered by uncompleted contracts	9,642.66	
		9,828.79
July 1, 1902, balance available		11,557.72

ALLOTMENT.

Appropriation for "Gun and Mortar Batteries," act May 25, 1900 $30,000.00

Abstract of contracts in force.

Name of contractor: Jac. Heffelfinger.
Date of approval: May 2, 1902.
Rate for 38,118 feet B. M. of yellow pine lumber: $600.
Date of delivery: Thirty days after May 5, 1902.
Date of expiration: June 3, 1902.

Name of contractor: Clinton Point Stone Company.
Date of approval: May 6, 1902.
Rates: 2-inch broken stone, $1.50 per cubic yard; 1-inch broken stone, $1.50 per cubic yard; granolithic stone, $1.50 per cubic yard.
Date of delivery: 300 and 200 cubic yards of 2-inch and 1-inch stone to be delivered within thirty days from June 1, 1902, and the balance at the rate of 500 cubic yards per month.
Date of expiration: October 15, 1902.

Name of contractor: B. Wallis & Co.
Date of approval: May 10, 1902.
Rates: Anchor bolts, $3 each; steel I-beams and channel beams, 3¾ cents per pound; connection angles and bolts, 5 cents per pound; steel plates for table of hoist, 6½ cents per pound; steel plates and angles, 5 cents per pound; lot of cast-iron soil pipe, $40; lot of galvanized-iron pipe and fittings, $100.
Date of delivery: Forty-five days from May 14, 1902.
Date of expiration: Time limit waived.

Name of contractor: New Jersey Foundry and Machine Company.
Date of approval: May 13, 1902.
Rates: For wrought-iron doors "B," $25 per set; for wrought-iron doors "C," $5 each; wrought-iron anchor bolts "E," 6 cents per pound; wrought-iron anchor bolts "H" and "K," 6 cents per pound; bolts and nuts, 10 cents per pound; expansion bolts and shields, 10 cents per pound; cast-iron basin frames and covers, 3½ cents per pound; cast-iron frames "A," 6 cents per pound; cast-iron frames "F," 6 cents per pound; cast-iron columns, 5 cents per pound; cast-iron anchor plates, 5 cents per pound.
Date of delivery: June 14, 1902.
Date of expiration: Time limit waived.

Emplacements for four 3-inch rapid-fire guns.—This battery has been completed as far as practicable until arrival of the mounts. The work performed during the fiscal year included the cleaning and painting of the ceiling beams of the magazines, painting doors, cutting drains through floors of the magazines, and coating the vertical walls of the exterior of the battery with a mixture of lampblack and Portland cement.

Money statement.

July 1, 1901, balance unexpended	$2,824.94
June 30, 1902, amount expended during fiscal year	13.94
July 1, 1902, balance unexpended	2,811.00
July 1, 1902, outstanding liabilities	8.75
July 1, 1902, balance available	2,802.25

ALLOTMENT.

Appropriation for "Gun and Mortar Batteries," act July 7, 1898	$12,500.00

Mortar battery.—The available balance of the allotment for removing the construction plant and cleaning up about the mortar battery was expended in taking down the 4-foot cubical concrete mixer, storing the machinery, taking up and relaying the railroad track, and cleaning up about the battery.

Money statement.

July 1, 1901, balance unexpended	$1,000.00
June 30, 1902, amount expended during fiscal year	1,000.00

ALLOTMENT.

Appropriation for "Gun and Mortar Batteries," act May 25, 1900	$1,000.00

Building for mortar-battery electric plant.—In completing this structure and transferring and connecting up the storage battery the following work was performed during the fiscal year: Slopes were completed; door and window frames were set; storage battery, rack, and switch board were taken down, and set up in the new plant building, and ventilator pipe put in.

Money statement.

July 1, 1901, balance unexpended	$2,295.80
June 30, 1902, amount expended during fiscal year	2,295.80

ALLOTMENT.

Appropriation for "Gun and Mortar Batteries," act May 25, 1900	$2,900.00

New azimuth circles at mortar battery.—Work was continued under the allotments made, and the following operations were carried on during the fiscal year: The four 1891 model carriages and their mortars were dismounted by the troops, after which the size of the platform wells was enlarged by cutting out the concrete, and extension pieces were placed on the old anchor bolts so as to lengthen them to take the model 1896 carriage. The base rings for the model 1896 carriages have been set and the azimuth circles for two of the carriages placed. Portland concrete, amounting to about 8 cubic yards, was mixed and placed around the base rings.

Money statement.

July 1, 1901, balance unexpended		$250.47
June 30, 1902, allotted during fiscal year		700.00
		950.47
June 30, 1902, expended during fiscal year		154.51
July 1, 1902, balance unexpended		795.96
July 1, 1902, outstanding liabilities		335.97
July 1, 1902, balance available		459.99

ALLOTMENTS.

Appropriation for "Gun and Mortar Batteries," act May 25, 1900 (aggregate)	$1,100.00

Battery commander's station.—This station had been completed at the close of the fiscal year 1901 and was transferred to the care of the artillery troops October 17, 1901.

The expenditures made during the fiscal year 1902 were in settlement of outstanding accounts on June 30, 1901.

Money statement.

July 1, 1901, balance unexpended		$194.82
June 20, 1902, expended during fiscal year	$47.08	
June 30, 1902, amount repaid to appropriation during fiscal year	147.74	
		194.82

ALLOTMENT.

Appropriation for "Gun and Mortar Batteries," act May 25, 1900	$6,000.00

Fire commander's station.—The sum of $6,161.94 was provided by allotment of November 26, 1901, and a contract for the structural-steel material was made April 11, 1902.

The site has been graded to reference for starting the foundation during the fiscal year.

Money statement.

June 30, 1902, allotted during fiscal year		$6,161.94
June 30, 1902, amount expended during fiscal year		347.40
July 1, 1902, balance unexpended		5,814.54
July 1, 1902, outstanding liabilities	$60.63	
July 1, 1902, amount covered by uncompleted contracts	2,481.00	
		2,541.63
July 1, 1902, balance available		3,272.91

Abstract of contract in force.

Name of contractor: Ellicott Machine Company.
Date of approval: April 26, 1902.
Rate for structural steel and iron for one fire commander's and five battery commanders' stations: $14,847.
Dates of delivery: First tower, July 29; second tower, August 18; third tower, August 28; fourth tower, September 5; fifth tower, September 17; and sixth tower (date of expiration), September 27, 1902.

Five battery commanders' stations.—An allotment of $31,227.13 was made for the erection of these stations November 26, 1901, and a contract was made April 11, 1902, for all the structural steel material required for their erection.

At the sites for towers Nos. 2, 3, and 5 the foundations have been finished. At site No. 4 the foundation has been built up of rubble stone to 4 feet above mean low water, and the sheathing for the concrete walls erected.

For filling to foundation reference at the sites 237 cubic yards of sand have been handled, and for forming the sand slopes about the foundations 697 cubic yards were required. In providing the foundations for towers Nos. 2, 3, and 4, 332 cubic yards of concrete were mixed and placed and 196 cubic yards of sand rammed between the foundation walls. The site for tower No. 4 being low, the fill to reference of starting foundation was made with granite blocks, about 88 cubic yards of this having been placed.

All the towers will probably be completed and ready for transfer to the artillery by December 31, 1902.

Money statement.

June 30, 1902, allotted during fiscal year		$31,227.13
June 30, 1902, expended during fiscal year		2,435.55
July 1, 1902, balance unexpended		28,791.58
July 1, 1902, outstanding liabilities	$945.77	
July 1, 1902, amount covered by uncompleted contracts	12,405.00	
		13,350.77
July 1, 1902, balance available		15,440.81

Abstract of contract in force.

Name of contractor: Ellicott Machine Company.

Date of approval: April 26, 1902.

Rate for structural steel and iron for one fire commander's and five battery commanders' stations, $14.847.

Dates of delivery: First tower, July 29; second tower, August 18; third tower, August 28; fourth tower, September 5; fifth tower, September 17, and sixth tower (date of expiration), September 27, 1902.

Electric plant.—The building for the generating set and storage battery has been completed during the fiscal year, which required 225 cubic yards of concrete for the walls and roof, the setting of the roof beams, and filling in between same with 576 square feet of hollow brick. Doors and windows were framed, painted, and placed, and 53 square yards of granolithic finish put down for floor of power room and walkway.

The generating set will be installed early in the fiscal year 1902, and the several storage batteries of the emplacements to be served by the plant will be moved to the building and combined into one.

Money statement.

July 1, 1901, balance unexpended	$9,551.75
June 30, 1902, expended during fiscal year	3,968.84
July 1, 1902, balance unexpended and available	5,582.91

ALLOTMENTS.

Appropriation for "Gun and Mortar Batteries," act March 1, 1901	$5,505.00
Appropriation for "Supplies for Seacoast Defenses," act May 25, 1900	4,655.00
	10,160.00

Electrical installation for maneuvering 12-inch armament.—The sum of $3,000 was provided March 31, 1902, for supplying the terminals and power for the experimental apparatus contracted for by the Ordnance Department to elevate, retract, and traverse two of the 12-inch carriages and guns.

For sheltering the generating set a small building was erected near the 12-inch battery, and the dynamo, engine, switch board, etc., pertaining to one of the 30-inch searchlight sets were taken to the building and installed therein. The cable connections were laid, which required 3,235 feet of lead-covered cable. The plant was completed at the close of the fiscal year, with the exception of moving and setting up the storage battery for lighting the emplacements in an apartment provided for it in the new power house.

Money statement.

GUN AND MORTAR BATTERIES.

June 30, 1902, amount allotted during fiscal year	$3,000.00
June 30, 1902, expended during fiscal year	1,338.05
July 1, 1902, balance unexpended	1,661.95
July 1, 1902, outstanding liabilities	311.26
July 1, 1902, balance available	1,350.69

Electric system at mortar battery.—The sum of $3,400 was allotted April 14, 1902, for renewing the interior wiring of the mortar battery. No work has been done.

Money statement.

GUN AND MORTAR BATTERIES.

June 30, 1902, allotted during fiscal year	$3,400.00
July 1, 1902, balance unexpended and available	3,400.00

Installation of ammunition hoist at Redoubt C.—For test purposes, the installation of a Hodges front-delivery chain hoist is to be installed in one of the emplacements of Redoubt C, $2,275 being allotted therefor.

No work has been done.

Money statement.

GUN AND MORTAR BATTERIES.

June 30, 1902, allotted during fiscal year	$2,275.00
July 1, 1902, balance unexpended	2,275.00

Sea wall.—During the fiscal year 1902, 333 linear feet of concrete sea wall between the engineer wharf and the first jetty on the beach were constructed and 3,450 cubic yards of sand placed for filling behind it. The wall now extends 508 feet from the jetty.

Money statement.

July 1, 1901, balance unexpended	$18,012.81
June 30, 1902, expended during fiscal year	7,734.86
July 1, 1902, balance unexpended	10,277.95
July 1, 1902, outstanding liabilities	875.76
July 1, 1902, balance available	9,402,19

ALLOTMENTS.

Appropriation for "Sea Walls and Embankments:"	
Act May 25, 1900	$12,000.00
Act March 1, 1901	11,000.00
Total	23,000.00

Supplies for seacoast defenses.—An allotment of $1,000 was made for the purchase of approved articles to be supplied by the Engineer Department to the artillery in connection with seacoast defenses. All requisitions have been filled, as approved, except the one for the quarter ending June 30, 1902, which was received too late to purchase the articles before the close of the fiscal year.

Money statement.

July 1, 1901, balance unexpended	$1,004.38
June 30, 1902, allotted during fiscal year	1,000.00
	2,004.38
June 30, 1902, expended during fiscal year	1,975.08
July 1, 1902, balance unexpended	29.30

Preservation and repair of fortifications.—The allotments from the appropriation for work in the fiscal year 1902 amounted to $1,700, and together with the balance available July 1, 1901, which was $2,731.51, the repairs noted below were made. Of the amount allotted during the year, $600 was provided for the payment of the salary of an expert electrician employed under the orders of the commanding officer of the artillery district of the Chesapeake, who has served to the close of the fiscal year under the orders of said officer.

At redoubts B and C drain pipes were run underneath the platforms from the counterweight wells to give positive drainage of the water which collected in the wells during rainfalls. This cost $209.

At Redoubt A and the 8-inch rifle in barbette nearby shelves and lockers were provided in the storage-battery room of the former, and the relocator room at the latter was repaired.

At the mortar battery the surface of the revet walls over each pit was coated with asphalt, and the opening made in each was filled with concrete after the excavation made behind the walls had been filled with broken stone.

Minor repairs were made at the other batteries, and on the main work the bridges over the moat were repaired, drains inside cleaned, and electric lamps placed in one of the magazines. New floors will be put down in this magazine as soon as the supply wires have been connected with the exterior wiring.

Money statement.

July 1, 1901, balance unexpended	$2,986.37
June 30, 1902, allotted during fiscal year	1,800.00
	4,786.37
June 30, 1902, expended during fiscal year	2,409.47
July 1, 1902, balance unexpended	2,376.90
July 1, 1902, outstanding liabilities	338.73
July 1, 1902, balance available	2,038.17

ALLOTMENTS.

Appropriation for "Preservation and Repair of Fortifications:"	
Act of February 14, 1902	$600.00
Act of June 6, 1902	1,200.00
	1,800.00

SOUTH SIDE OF CHANNEL.

Emplacements for two 6-inch rapid-fire guns, disappearing carriages.—After investigation had been made to determine whether it would be feasible to construct a battery of two 12-inch guns at this point, it was decided there was little likelihood of putting in a foundation, by piling or otherwise, which would sustain the weight of such a battery without some settlement, and it was considered advisable to replace this proposed high-power armament by a battery of two 6-inch rapid-fire guns on disappearing carriages.

No work will be done toward the construction of the 6-inch emplacements for rapid-fire guns until after the tests have been made to determine the best type of carriages in use, provided for in the recent fortification appropriation act.

The expenditures during the fiscal year were made in connection with the preparation of plans and specifications for construction material required for the emplacements.

Money statement.

June 30, 1902, allotted during fiscal year	$34,000.00
June 30, 1902, expended during fiscal year	330.65
July 1, 1902, balance unexpended and available	33,669.35

ALLOTMENT.

Appropriation for "Gun and Mortar Batteries" act March 1, 1901	$34,000.00

Emplacements for four 3-inch rapid-fire guns.—By an allotment of $40,000 provision was made for the construction of this battery, the building of a wharf, and the purchase of a launch needed in carrying on the work of construction.

The parapet of this battery is to be formed wholly of concrete, it being thought advisable to omit the use of sand on account of the close proximity of the toe of the exterior slope to the water, which would cause a continuous erosion of a parapet of the latter material.

During the fiscal year a wharf, which extends out 197 feet and is 152 feet on the face, was built under contract at a cost of $7,450. The plant for use in building the battery has been assembled and placed. The site for the battery has been filled to foundation reference with 1,617 cubic yards of dimension stone which was available at the fort, and the sheathing for concrete has been erected to form the magazines and vertical walls.

The expenditures during the fiscal year, besides the cost of the wharf and work enumerated above, includes the first cost, repair, and maintenance of a steam launch purchased to transport employees and supplies to and fro.

Money statement.

June 30, 1902, allotted during fiscal year		$40,000.00
June 30, 1902, expended during fiscal year		17,064.96
July 1, 1902, balance unexpended		22,935.04
July 1, 1902, outstanding liabilities	$937.62	
July 1, 1902, amount covered by uncompleted contracts	7,107.35	
		8,044.97
July 1, 1902, balance available		14,890.70

Abstract of contracts in force.

Name of contractor: Richard Parrott.
Date of approval: December 17, 1901.
Rate: $7,450 for wharf.
Date of commencement: December 23, 1901.
Date of expiration: May 7, 1902.

Name of contractor: Duke and Smith.
Date of approval: April 11, 1902.
Rates: For 37,300 feet, B. M., yellow pine lumber, $593.80; 60 cents each for yellow pine ties 5 inches by 8 inches by 7 feet.
Date of delivery: 45 days from April 15, 1902.
Date of expiration: May 6, 1902.

Name of contractor: New Jersey Foundry and Machine Company.
Date of approval: April 22, 1902.
Rates: Anchor bolts $1.52 each; steel I-beams $3\frac{67}{100}$ cents per pound; steel channel beams $3\frac{67}{100}$ cents per pound; cast-iron basin frames $3\frac{15}{100}$ cents per pound; cast-iron anchor plates $3\frac{12}{100}$ cents per pound.
Date of delivery: 60 days from April 24, 1902.
Date of expiration: July 24, 1902 (time limit waived).

Name of contractor: The Atlas Portland Cement Company.
Date of approval: April 22, 1902.
Rate: For Portland cement, $1.51 per barrel.
Date of delivery: 1,000 barrels within 30 days from June 1, 1902.
Date of expiration: Indefinite.

Name of contractor: Clinton Point Stone Company.
Date of approval: April 29, 1902.
Rates: For 2-inch, 1-inch, and granolithic broken stone, $1.50 per cubic yard, each size.
Date of delivery: 300 and 200 cubic yards of 2-inch and 1-inch broken stone, respectively, within 30 days from June 1, 1902, and 20 cubic yards of granolithic stone within 60 days from same date.
Date of expiration: Indefinite.

2 K.

DEFENSES OF THE COAST OF NORTH CAROLINA.

Officer in charge, Capt. Eugene W. Van C. Lucas, Corps of Engineers; Division Engineer, Col. Peter C. Hains, Corps of Engineers.

Defense of entrance to Beaufort Harbor.—No work was done during the year. Two 12-pounder field guns were dismounted and shipped from the post without notice to this office.

Reservation at Southport.—No work was done during the year. The suits for possession of the reservation or parts thereof were settled by payment from appropriation for improvement of Cape Fear River, North Carolina. This reservation is not included in the scheme for the defense of the mouth of the Cape Fear River and will no longer be included in the report on the defenses of North Carolina.

Defense of mouth of Cape Fear River.—At the beginning of the fiscal year the battery of eight 12-inch mortars had been completed, but not transferred on account of the unequal settlement of the carriage foundations in the eastern pit. This settlement having ceased, the work of releveling was taken up and has been nearly completed. Transfer to the garrison will probably be made in a few weeks.

During the year one emplacement for 5-inch rapid-fire gun was transferred to the garrison after the carriage had been mounted.

At the beginning of the fiscal year a sea wall had been built on the exposed side and both ends of the post from funds provided by a special item of $150,000 in the fortification appropriation act of May 25, 1900. During the year all low places included within the sea wall were filled to approximately 12 feet above mean low water. Work is now in progress restoring wagon roads and railroads, and planting grass to prevent blowing sand. Details concerning grass protection are given in the separate appendix. (See Appendix Z Z 5.)

The battery for two 3-inch and one 5-inch rapid-fire guns had been started at the beginning of the year, and the 3 inch emplacements were completed during the year. The completion of the 5-inch emplacement awaits the adoption by the Ordnance Department of an acceptable type of mounting for the 5-inch rapid-fire gun.

The fire commander's station, designed for the Lewis range finder at low sites, has been completed and transferred to the garrison. Some minor work of storing plant and clearing up around the site remains to be done.

From the appropriation for "Supplies for Seacoast Defenses" the garrison has from time to time been supplied with needed material on requisitions approved by the Chief of Engineers.

From the appropriation for "Supplies for Seacoast Defenses" an allotment has been made for rewiring batteries, the original wiring installation having been found defective and rapidly deteriorating. A contract has been made for this rewiring under specifications which, it is believed, will result in a thoroughly satisfactory and reasonably permanent system, and the work thereunder will be completed within a few weeks.

With an allotment from the appropriation for "Preservation and Repair of Fortifications," general work of maintenance of all emplacements has been carried on during the year. This work includes repairs to drainage service, pavements, parapets, ammunition lifts, etc. The most notable work done under this appropriation has been the stoppage of leaks in concrete emplacements by the application of boiled linseed oil, details of which are given in Appendix Z Z 5.

Money statements.

GUN AND MORTAR BATTERIES.

Mounting eight 12-inch mortars and carriages.

July 1, 1901, balance unexpended	$43.06
June 30, 1902, amount expended during fiscal year	43.06

Emplacements for two 5-inch rapid-fire guns.

July 1, 1901, balance unexpended	$129.67
June 30, 1902, amount expended during fiscal year	126.07
July 1, 1902, balance unexpended	3.60
July 1, 1902, outstanding liabilities	3.60

Mortar battery.

July 1, 1901, balance unexpended	$1,400.00
June 30, 1902, amount expended during fiscal year	579.87
July 1, 1902, balance unexpended	820.13
July 1, 1902, outstanding liabilities	.75
July 1, 1902, balance available	819.38

Contract work—Eight-inch emplacements.

July 1, 1901, balance unexpended	$10.41
July 1, 1902, outstanding liabilities	10.41

Fire commander's station.

July 1, 1901, balance unexpended	$5,247.95
June 30, 1902, amount expended during fiscal year	4,498.46
July 1, 1901, balance unexpended and available	749.49

Emplacements for one 5-inch and two 3-inch rapid-fire guns.

July 1, 1901, balance unexpended	$5,121.40
October 1, 1901, amount from allotment for sea wall to correct error	1,700.00
	6,821.40
June 30, 1902, amount expended during fiscal year	6,425.02
July 1, 1902, amount unexpended and available	396.38

PRESERVATION AND REPAIR OF FORTIFICATIONS.

July 1, 1901, balance unexpended	$1,634.69
June 30, 1902, amount expended during fiscal year	1,506.85
July 1, 1902, balance unexpended and available	127.84

SEA WALL.

July 1, 1901, balance unexpended	$84,617.63
June 30, 1902, amount expended during fiscal year	76,560.66
July 1, 1902, balance unexpended	8,056.97
July 1, 1902, outstanding liabilities	84.01
July 1, 1902, balance available	7,972.96

SUPPLIES FOR SEACOAST DEFENSES.

July 1, 1901, balance unexpended	$700.00
June 30, 1902, amount expended during fiscal year	413.34
July 1, 1902, balance unexpended and available	286.66

Rewiring batteries.

October 17, 1901, amount allotted	$3,000.00
June 30, 1902, amount expended during fiscal year	88.87
July 1, 1902, balance unexpended	2,911.13
July 1, 1902, outstanding liabilities	.35
July 1, 1902, balance available	2,910.78

2 L.

DEFENSES OF THE COAST OF SOUTH CAROLINA.

Officer in charge, Capt. James C. Sanford, Corps of Engineers; assistant, Lieut. Edwin R. Stuart, Corps of Engineers, until August 15, 1901; Division Engineer, Col. Peter C. Hains, Corps of Engineers.

CHARLESTON HARBOR, SOUTH CAROLINA.

Twelve-inch battery.—A project was submitted for completing this battery which comprised the following:

In front: Remove old timber structures; cut down front wall and tops of old magazines, to give the guns a depression of 3 degrees; dispose of old guns; fill the hole between the battery and the front wall and raise the southwest wall to the general grade; cover top of filling with salt marsh, which, after remaining a year, should be planted with grass roots.

In rear: Remove old work above level of 23 feet (datum mean low water); level off the parade to about the same elevation as the loading platforms of the guns.

General: Repair north corner of the southeast exterior wall; replace large stone which had been moved to make torpedo gallery, now abandoned; repair old concrete pavement just outside of sally port; build concrete pavement in the gallery extending from the sally port to the 12-inch battery; clean up old timber, etc., outside the walls. Of this work the following has been done: Old wooden structures in front of guns have been removed.

The removal of old masonry work projecting above grade has been practically completed. The front wall has been cut down and new coping built on the remaining portion. The 15-inch guns and 200-pounder Parrotts have been buried in the earthwork of the fort. The hole in front of the battery has been about two-thirds filled. The filling material was mainly secured by dredging with the Government plant, and this work had progressed very satisfactorily until the work upon the extension of the wharf was begun in June by the Quartermaster's Department. It will be necessary to discontinue this work of filling until the completion of the quartermaster's wharf. About one-fourth of the parade has been leveled off. The southeast wall has been repaired, and the gap in the southwest wall has been filled by a wall of concrete and brick similar to the other exterior wall. The work was all done by hired labor and the use of the Government plant, the necessary material having been purchased under ten-day bids.

Money statement.

Amount allotted October 31, 1901	$18,800.00
June 30, 1902, amount expended during fiscal year	8,250.25
July 1, 1902, balance unexpended	10,549.75
July 1, 1902, outstanding liabilities	2,815.89
July 1, 1902, balance available	7,733.86

Three emplacements for 3-inch rapid-fire guns.—For history of this work prior to June 30, 1901, see page 861, Annual Report of the

Chief of Engineers for 1899, and page 913, Annual Report of the Chief of Engineers for 1900. During the fiscal year 1901 this battery had been completed and the balance available turned into the Treasury. The battery was turned over to the artillery July 16, 1901.

Installation of an electric-light plant, 12-inch battery.—The plant had been installed, excepting the storage battery, which is not to be built at present. The balance of the allotment for this purpose had been turned in, excepting $900, with which sum it was intended to build a brick boiler house and purchase a new boiler. Plans were prepared for a boiler, but it having been decided that it was impracticable to build a suitable boiler house on the site proposed, nothing was done.

Money statement.

GUN AND MORTAR BATTERIES.

July 1, 1901, balance unexpended		$1,984.42
June 30, 1902, amount expended during fiscal year	$2.14	
Withdrawn by Chief of Engineers	1,084.42	
		1,086.56
July 1, 1902, balance unexpended and available		897.86

Preservation and repair of fortifications.—During the fiscal year 1902 the following work was done: At the 10-inch battery the shot lifts were painted, repairs were made to trolleys and oil engines, railings were built around gun platforms, and these railings were painted. Some repairs were made to the ammunition hoists during the early part of the year. Some minor work was done on drains, and the gutters on the parapet were repaired. Some new mouthpieces for speaking tubes were put in.

At the mortar battery the remaining battens in mortar pits were removed and holes filled with concrete. A leak over the switchboard was stopped and other work was done for the betterment of the dynamo room and for repairing the electric-light plant. The drainage ditch was completed. The wharf was repaired by driving 20 metaled piles and 5 fender piles and partially completing the superstructure on the head. Bids were first invited for this work. The work was done by Government plant, as no favorable bids were received. All Engineer plant and property were cared for. The inner walls of the batteries were painted with a white coat to secure better light. The concrete base for the searchlight dynamo was taken out and replaced and other work of repairs was done upon the searchlight plant. Sand that had been washed away in rear of the 6-inch battery was replaced and some wooden drains built to prevent further washing away of sand. Some of the ironwork of the batteries was painted.

An allotment of $1,200 was made to pay the salary of an expert electrician. No one has yet been employed.

Money statements.

July 1, 1901, balance unexpended	$2,301.31
Amount allotted August 16, 1901	150.00
	2,451.31
June 30, 1902, amount expended during fiscal year	2,422.36
July 1, 1902, balance unexpended	28.95
July 1, 1902, outstanding liabilities	28.50
July 1, 1902, balance available	.45

CIVILIAN ELECTRICIAN.

June 27, 1902, amount allotted	$1,200.00
July 1, 1902, balance unexpended and available	1,200.00

At the 12-inch battery repairs were made to the Engineer wharf by driving 9 metaled piles and 5 fender piles. The superstructure was also repaired. I-beams and doors were painted. Wooden battens were removed from loading platforms and the holes were filled with cement mortar. Hand railings, doorsteps, etc., were painted. Holes were cut in the floors for temporarily draining the rooms and passages. Iron covers were prepared and placed over these holes. The bottom of the gun pit of the disappearing gun was surfaced with cement mortar to give better drainage to the pit. Iron shutters were placed in the relocator-room windows. Tie-rods to the wharf were painted.

Money statement.

July 1, 1901, balance unexpended	$1,132.06
June 30, 1902, amount expended during fiscal year	962.91
July 1, 1902, balance unexpended	169.15
July 1, 1902, outstanding liabilities	78.53
July 1, 1902, balance available	90.62

At the 10-inch battery plans were submitted for improving the lifts and subsequently for substituting chain hoists for the existing lifts. An allotment of $200 for repairs to these ammunition hoists was withdrawn in September, and the balance of allotment of $500 of May 4, 1901, was redeposited to the credit of the appropriation for "Preservation and Repair of Fortifications." The lower end of the outlet drain had been broken up by the action of the sea. An allotment of $100 was made for repairing this temporarily. This work was done.

Money statement.

July 1, 1901, balance unexpended		$500.00
June 30, 1902, amount allotted during fiscal year		300.00
		800.00
September 23, 1901, amount withdrawn	$200.00	
October 31, 1901, amount deposited to credit of Treasurer United States	456.49	
June 30, 1902, amount expended during fiscal year	43.51	
		700.00
July 1, 1902, balance unexpended		100.00
July 1, 1902, outstanding liabilities		21.50
July 1, 1902, balance available		78.50

At the mortar battery the damaged portion of the sloping wall in the southeast pit was removed and replaced with Portland-cement concrete. The old wall was cut away for about one-half of its thickness and iron cramps were inserted in the work at frequent intervals to aid in holding old and new concrete together. About 85 cubic yards were thus replaced. All of the sloping walls were gone over with wire brushes, and then washed with a grout of Portland-cement mortar. Proposals were invited and material purchased for an inner ceiling for the relocator room. No work has yet been done on this.

Money statement.

June 30, 1902, amount allotted during fiscal year		$1,950.00
June 30, 1902, amount expended during fiscal year	$1,568.08	
Amount deposited to credit Treasurer United States	131.92	
		1,700.00
July 1, 1902, balance unexpended		250.00
July 1, 1902, outstanding liabilities		70.62
July 1, 1902, balance available		179.38

Torpedo storehouse.—The contract with Mr. George H. Crafts for the construction of a brick torpedo storehouse was approved July 18, 1901. Work was begun in September, 1901, and completed in January, 1902. A balance of $740.34 was turned into the Treasury. The building was transferred to the artillery March 1, 1902.

Money statement.

TORPEDOES FOR HARBOR DEFENSE.

July 1, 1901, balance unexpended		$6,368.30
June 30, 1902, amount expended during fiscal year	$5,627.96	
Deposited to credit Treasurer United States	740.34	
		6,368.30

Cable tank.—Plans for a new cable tank to be constructed in the rear of the storehouse, on the old parade ground, were submitted and approved. An allotment of $1,500 was made for the construction of this tank. No work has been done.

Money statement.

TORPEDOES FOR HARBOR DEFENSE.

June 20, 1902, amount allotted	$1,500.00
July 1, 1902, balance unexpended and available	1,500.00

Battery commander's station.—No work was done. On October 23, 1901, $3,000 of the allotment in the Treasury was withdrawn, and on October 25, 1901, the balance of the allotment in hand ($1,961.66) was turned into the Treasury.

Money statement.

GUN AND MORTAR BATTERIES.

July 1, 1901, balance unexpended		$4,961.66
October 31, 1901, withdrawn by Chief of Engineers	$3,000.00	
October 31, 1901, deposited to credit Treasurer United States	1,961.66	
		4,961.66

Supplies for seacoast defenses.—The following allotments were made from the appropriation for "Supplies for Seacoast Defenses," act of May 25, 1900: On June 7, 1900, $800, and on June 7, 1902, $500, to be applied to filling such requisitions as may be duly approved by the Chief of Engineers. Five requisitions have been received during the year from the post engineer officer through the Chief of Engineers. All of these requisitions have been filled except the last, dated June 17, 1902. The bids for materials, etc., covered by this last requisition were opened July 1, 1902. It is intended to cover supplies for the quarter ending September 30, 1902.

Money statement.

July 1, 1901, balance unexpended		$766.63
June 17, 1902, allotment		500.00
		1,266.63
June 30, 1902, amount expended during fiscal year		522.51
July 1, 1902, balance unexpended		744.12
July 1, 1902, outstanding liabilities		70.00
July 1, 1902, balance available		674.12

PORT ROYAL, SOUTH CAROLINA.

Preservation and repair of fortifications.—Some work was done in cleaning and painting. A board walk was built in the rear of the 10-inch battery. The engineer plant was removed and the watchman discharged.

Money statement.

July 1, 1901, balance unexpended		$246.82
Amount allotted July 3, 1901	$1,000.00	
Amount allotted October 24, 1901	300.00	
		1,300.00
		1,546.82
June 30, 1902, amount expended during fiscal year		1,515.43
July 1, 1902, balance unexpended and available		31.39

Torpedoes for harbor defenses.—All of the torpedo material was turned over to the artillery in July, 1901.

Dynamite battery.—On November 9, 1900, a provisional allotment of $50,000 was made from the appropriation for "Gun and Mortar Batteries." This allotment was to construct the parapets and magazines for the pneumatic dynamite gun intended for the defense of this harbor. On January 15, 1901, this allotment was made available, and an additional allotment of $14,800 was made from the same appropriation. Plans had been submitted and approved at the end of the last fiscal year. At the beginning of this fiscal year the gun and machinery were in position, but the work had not reached a stage to permit of the construction of the parapet and magazines. No work was done in the fiscal year 1902. On July 24, 1901, the Secretary of War ordered that all work on dynamite-gun batteries be stopped. In compliance with this order the allotments were withdrawn.

2 M.

DEFENSES OF THE COAST OF GEORGIA AND OF CUMBERLAND SOUND, GEORGIA AND FLORIDA.

Officer in charge, Capt. Cassius E. Gillette, Corps of Engineers; Division Engineer, Col. Peter C. Hains, Corps of Engineers.

Mortar battery.—The grounds were cleaned up, sod repaired, and plans for electric lighting, including the general subject of electric lighting of the post, submitted.

Money statement.

July 1, 1901, balance unexpended	$4,393.27
June 30, 1902, amount expended during fiscal year	388.68
July 1, 1902, balance unexpended and available	4,004.59

Preservation and repair of fortifications.—There were allotted and transferred from other work, during the fiscal year, $1,492.77 for work of preservation and repair and for hire of an electrician. Work was done covering blowing sand, and minor repairs, such as making guides to shot lifts, installing hygrometers and thermometers, grading fills, whitewashing walls, and cleaning drains. Minor additions, such as locks, etc., were made.

Money statement.

July 1, 1901, balance unexpended	$1,600.85
June 30, 1902, amount allotted during fiscal year	1,492.77
	3,093.62
June 30, 1902, amount expended during fiscal year	1,721.61
July 1, 1902, balance unexpended	1,372.01
July 1, 1902, outstanding liabilities	66.98
July 1, 1902, balance available	1,305.03

Drain holes were cut in the floors of the magazines and storerooms of the 3-inch rapid-fire battery. The sum of $150.77 was transferred to another work.

Money statement.

July 1, 1901, balance unexpended		$242.74
June 30, 1902, expended during fiscal year	$91.97	
Amount transferred	150.77	
		242.74

Preservation and repair of fortifications, Fort Clinch, Fla.—No work was done. The balance of funds on hand, $679.58, was deposited to the credit of the appropriation on October 21, 1901.

Money statement.

July 1, 1901, balance unexpended	$679.58
Amount deposited to credit of the appropriation	679.58

Supplies for seacoast defenses.—Three hundred dollars was reallotted on July 12, 1901. Supplies were furnished at a cost of $7.46.

Money statement.

June 30, 1902, amount allotted during fiscal year	$300.00
June 30, 1902, amount expended during fiscal year	7.46
July 1, 1902, balance unexpended and available	292.54

2 N.

DEFENSES OF EAST COAST OF FLORIDA AND OF KEY WEST, FLORIDA

Officers in charge, Capt. Thomas H. Rees, Corps of Engineers, until August 10, 1901; Lieut. Edmund M. Rhett, Corps of Engineers, from August 10, 1901, to September 11, 1901, and Capt. Herbert Deakyne,

Corps of Engineers, since September 11, 1901; assistant, Lieut. Edmund M. Rhett, Corps of Engineers, until August 10, 1901; Division Engineer, Col. Peter C. Hains, Corps of Engineers.

DEFENSES OF EAST COAST OF FLORIDA.

Preservation and repair, Fort Marion, Fla.—For a brief historical sketch of this work, which was built during the Spanish possession of Florida and finished in 1756, attention is invited to the annual report of the officer in charge for 1889. It is not available for defense, but is worthy of preservation as an object of historical interest.

At the beginning of the fiscal year a balance remained of former allotment for preservation and repair. This amount was expended in plastering the walls and ceiling of casemate No. IV, the first one to the left of the sally port on entering, and renewing the woodwork of doors and windows of the said casemate.

Money statement.

July 1, 1901, balance unexpended	$112.36
June 30, 1902, amount expended during fiscal year	112.36

Preservation and repair of fortifications, St. Johns River, Florida.—A watchman was employed during the year overhauling, cleaning, applying preservatives to, and storing away the mining material. The semiannual inspections of the mining material were made in November, 1901, and May, 1902.

Money statement.

July 1, 1901, balance unexpended	$1,289.24
June 30, 1902, expended during the fiscal year	899.33
July 1, 1902, balance unexpended	389.91
July 1, 1902, outstanding liabilities	60.00
July 1, 1902, balance available	329.91

Sites for fortifications.—A deed from the United States marshal for the southern district of Florida to the United States for 117.7 acres of land at St. Johns Bluff was received on April 11, 1902, and was recorded in the records of circuit court, Duval County, Jacksonville, Fla., on April 15, 1902. On June 5, 1902, an allotment of $50 was made and the expenditure of the balance remaining from the allotment made for the acquisition of land and for contingent expenses connected therewith was authorized for the purpose of marking the boundaries of the reservation acquired with stone monuments.

DEFENSES OF KEY WEST, FLORIDA.

Emplacements for four 10-inch and two 8-inch guns on disappearing carriages and for eight 12-inch mortars.—These emplacements are being built by contract under the provisions of the act of June 6, 1896. A contract was entered into with the Venable Construction Company, of Atlanta, Ga., on March 7, 1897, the work to be completed by January 1, 1898. Progress was slow and unsatisfactory, and a number of extensions of time were granted by the Secretary of War. The last extension of time expired July 23, 1900. On July 11, 1900, the contractor stated that he would make no further effort to complete the work.

New bids for completing the batteries and building storehouses were opened November 30, 1900, and the contract was awarded to the lowest bidder, L. L. Leach & Sons, of Chicago, to be completed August 13, 1901.

At the expiration of the time limit very little work had been done, and the time for completion was extended three months. The work was stopped on October 16, 1901, and was not resumed until December 30, 1901, the time limit of the contract having been waived. The work was greatly delayed by a lack of funds on the part of the contractors, causing much loss of time. Work was stopped March 13, 1902, and was resumed May 20, 1902. It was again stopped on June 11, 1902, and was not resumed before the close of the fiscal year.

Two of the three storehouses covered by this contract have been completed.

The work on the gun battery has been practically completed except the loam fill and the planting with Bermuda grass. Most of the loam fill has been placed and grass has been planted in it, but the loam has not yet shown its capacity to support vegetation, and until this is shown neither the loam nor the grass is accepted.

At the mortar battery very little has been done. The principal work remaining to be done consists of about 30 cubic yards of concrete, 1,800 cubic yards of sand and loam fill, and 8,000 square yards of grass planting.

Repair of leaks.—During the year attention was given to the repair of leaks in the older batteries. The most serious leak was that in one of the magazines of the gun battery. It was remedied by building an inner room with brick side walls and metal roof. Metal roofs were also placed in one relocating room and in one storage-battery room in same battery. The outside walls of dynamo room and storage-battery room in the mortar battery, and the walls of passage leading from the storage-battery room to the mortar pits were painted with two coats of coal tar.

Road covering for batteries at Key West, Fla.—No work was done during the year. (See Annual Report of Chief of Engineers, 1901, p. 827.)

Completing rear communications of 8 and 10 inch gun battery.—Owing to changes in the plans of these communications it was necessary to do some work not covered by previous contracts, and on February 10, 1902, a contract was entered into with Snare & Triest, of New York to do the work, which consisted chiefly in placing concrete, hand railing, sand and loam fill, and planting grass. At the close of the fiscal year this work was nearly completed.

Pumping plant for mortar battery.—To prevent the accumulation of water in the mortar pits, which are too low to be kept dry by natural drainage, a pumping plant was installed by the Tampa Foundry and Machine Company, at a cost of $2,150, under an emergency contract dated March 15, 1902. This plant consists of a centrifugal pump driven by an electric motor, with the necessary connections for suction and discharge. The plant is now in satisfactory operation.

Observation stations, mortar battery.—It was found that the observation stations of this battery, as originally planned, were so low that a considerable portion of the field of view was obstructed by a neighboring battery. Accordingly it was decided to increase the elevation of these stations, and an allotment of $1,500 for the additional work

was made July 18, 1901. Additional allotments were made November 7, 1901, and January 9, 1902, of $600 and $100, respectively.

The work of constructing the stations was done between October, 1901, and January, 1902. The hand railing and instrument bases remain to be placed.

The steps leading to these stations are included in the contract of Leach & Son for completing batteries and have not yet been constructed.

Money statements.

BATTERIES.

July 1, 1901, balance unexpended		$51,207.27
June 30, 1902, amount expended during fiscal year	$21,802.09	
February 10, 1902, amount withdrawn	21,720.41	
		43,522.50
July 1, 1902, balance unexpended and available		7,684.77

ROAD COVERING FOR BATTERIES.

July 1, 1901, balance unexpended	$1,141.62
May 15, 1902, amount transferred to other works	1,100.00
July 1, 1902, balance unexpended and available	41.62

OBSERVATION TOWERS.

July 18, 1901, amount allotted	$1,500.00
November 7, 1901, amount allotted	600.00
January 9, 1902, amount allotted	100.00
	2,200.00
June 30, 1902, amount expended during fiscal year	2,197.39
July 1, 1902, balance unexpended and available	2.61

Contracts in force.

Contractor: L. L. Leach & Son, Chicago, Ill.
Work: Completing batteries and building storehouses.
Date of approval: January 11, 1901.
Work began: April, 1901.
To be completed: Time limit waived.

Contractor: Snare & Triest, New York, N. Y.
Work: Completing rear communications of gun battery.
Date of approval: February 28, 1902.
Work began: May, 1902.
To be completed: July 3, 1902.

Emplacement for right flank 3-inch rapid-fire gun.—On April 17, 1901, the sum of $9,900 was allotted for this work from the appropriation for "Gun and Mortar Batteries," act of March 1, 1901. Work was begun in April, 1901, and was completed in September, 1901.

Money statement.

July 1, 1901, balance unexpended		$7,539.69
June 30, 1902, amount expended during fiscal year	$5,997.90	
May 2 and 15, 1902, amount transferred to other works	1,300.00	
		7,297.90
July 1, 1902, balance unexpended and available		241.79

Battery commander's station.—On August 3, 1900, the sum of $9,850 was allotted from the appropriation for "Gun and Mortar Batteries,"

act of May 25, 1900, for this work. A contract was entered into with the American Bridge Company, November 26, 1900, approved December 26, 1900, to be completed June 28, 1901. No work was done by the contractors previous to the expiration of the contract time, but they were allowed to proceed with the work under oral agreement at the price named in the contract, $4,949. The station was completed March 31, 1902, and was turned over to the artillery April 21, 1902.

Money statement.

July 1, 1901, balance unexpended	$9,133.78
June 30, 1902, amount expended during fiscal year	6,272.84
July 1, 1902, balance unexpended	2,860.94
July 1, 1902, outstanding liabilities	5.75
July 1, 1902, balance available	2,855.19

Preservation and repair of fortifications.—At the beginning of the fiscal year the amount unexpended for this purpose was $2,332.23. A further allotment of $1,200 was made June 27, 1902, for the payment of the salary of an electrician for one year.

A fort keeper was employed during the entire year and was paid from the first allotment except when he was employed for brief periods in connection with some piece of construction work, to which his services were then charged.

The ammunition lifts in the 8 and 10-inch battery were inspected, tested, scraped, and painted from time to time, and new parts were placed when necessary. A number of old and decaying doors in this battery were replaced with new ones. The engineer buildings were kept in good repair.

The submarine-mine material was cleaned and painted preparatory to its transfer to the artillery, which transfer was effected October 15, 1901. A grating was placed across the outer end of the cable gallery.

An experimental rack for sponges and rammers was built on the loading platform at one of the 8-inch emplacements. This has proved very satisfactory.

The lead-covered electric-light cables for the 8 and 10-inch battery which formerly lay underground were taken up when the work of remodeling the rear communications of this battery was undertaken and were placed against the wall on the rear face of the battery.

An experimental coating of "Indurine" paint was placed on the vertical wall around two of the loading platforms of this battery to reduce glare.

Money statement.

July 1, 1901, balance unexpended	$2,332.23
October 26, 1901, amount received (reimbursement from private parties for work done)	12.00
June 27, 1902, amount allotted for pay of electrician	1,200.00
	3,544.23
June 30, 1902, amount expended during fiscal year	2,252.53
July 1, 1902, balance unexpended	1,291.70
July 1, 1902, outstanding liabilities	80.69
July 1, 1902, balance available	1,211.01

Supplies for artillery.—At the beginning of the fiscal year there remained a balance of $20.45 from an allotment of $100 made May 10, 1900, from appropriation for "Preservation and Repair of Fortifications," act of March 3, 1899, for the purchase of supplies for electric-light plants at gun and mortar batteries, Key West, Fla. This balance has been expended during the year for the purpose stated.

Money statement.

July 1, 1901, balance unexpended	$20.45
June 30, 1902, amount expended during the fiscal year	20.45

Supplies for seacoast defenses.—At the beginning of the fiscal year there remained a balance of $553.38 from the allotment of $600 made June 7, 1900, from the appropriation for "Supplies for Seacoast Defenses," act of May 25, 1900. This fund has been drawn upon for the purchase of supplies upon requisitions approved by the Chief of Engineers.

Money statement.

July 1, 1901, balance unexpended	$553.38
June 30, 1902, amount expended during fiscal year	320.07
July 1, 1902, balance unexpended and available	233.31

20.

DEFENSES OF TAMPA BAY, FLORIDA.

Officers in charge, Capt. Thomas H. Rees, Corps of Engineers, until August 10, 1901; Lieut. Edmund M. Rhett, Corps of Engineers, from August 10, 1901, to September 11, 1901, and Capt. Herbert Deakyne, Corps of Engineers, since September 11, 1901; assistant, Lieut. Edmund M. Rhett, Corps of Engineers, until August 10, 1901; Division Engineer, Col. Peter C. Hains, Corps of Engineers.

Emplacements for two 3-inch rapid-fire guns.—At the close of the fiscal year ending June 30, 1901, some of the material for this work had been received and active operations of construction were about to begin. The work was begun in July and completed in October, 1901, as far as possible previous to the arrival of the mounts for the guns. Thus far the sum of $13,980.18 has been expended on these emplacements.

Money statement.

July 1, 1901, balance unexpended		$15,907.94
June 30, 1902, amount expended during fiscal year	$12,788.12	
January 23, 1902, transferred to other works	265.00	
October 26, 1901, returned to the Treasury	2,800.00	
		15,853.12
July 1, 1902, balance unexpended and available		54.82

Emplacement for one 3-inch rapid-fire gun.—Some preparatory work for this emplacement had been done prior to the close of the fiscal year ending June 30, 1901. Construction was started in October and was completed in December, 1901. This emplacement is ready for the gun, with the exception of placing the mount, which can be done when it arrives. The cost of this emplacement to date has been $9,968.32.

Money statement.

July 1, 1901, balance unexpended		$8,396.00
December 13, 1901, additional amount allotted		1,800.00
		10,196.00
June 30, 1902, amount expended during fiscal year	$9,964.32	
January 23, 1902, tranferred to other works	175.00	
		10,139.32
July 1, 1902, balance unexpended and available		56.68

Emplacements for three 3-inch rapid-fire guns.—This battery was formed by the modification of two emplacements for 8-inch rifles on 15-inch smoothbore carriages. The emplacements were completed in March, 1901, except about 75 cubic yards of concrete to be placed in the platforms after the arrival of the mounts for the guns. The cement for use in this concrete was on hand and in danger of deterioration. Accordingly, in December, 1901, and January, 1902, the platforms were completed with the exception of the slight amount of concrete immediately surrounding the base castings. This concrete, amounting to about 1 cubic yard, will be placed upon the arrival of the mounts. The expenditures on this work during the year were $499.11; total expenditures to date, $15,332.94.

Money statement.

July 1, 1901, balance unexpended	$166.17
January 23, 1902, amount transferred from other works	440.00
	606.17
June 30, 1902, amount expended during fiscal year	499.11
July 1, 1902, balance unexpended and available	107.06

Shore protection, 6-inch battery.—The shore line in front of the 6-inch battery having shown signs of rapid erosion, a sea wall was built to prevent encroachment. This wall is of concrete, with its foundation 2 feet below and its crest 5 feet above mean low-water level. Its length is 400 feet. Its cross-sectional area is 22 square feet. The cost was $2,400, or $6 per running foot.

Money statement.

May 2 and 15, 1902, amount allotted (being sums transferred from other works)	$2,400.00
June 30, 1902, amount expended during fiscal year	2,400.00

Emplacements for eight 12-inch mortars.—No construction work was done during the year. The eight mortars were received late in the fiscal year and had not been mounted at its close.

Preservation and repair of fortifications.—The amount available for this purpose at the beginning of the fiscal year was $441.70. During the year this fund was used for stopping leaks in 8-inch battery, placing sills in the doorways of the mortar battery to prevent rain water from blowing in under the doors, painting the doors of the several batteries, and erecting a pedestal for a Rafferty range-finder at the mortar battery.

Experiments were tried with "Indurine" for coating walls of emplacements to reduce glare, and a satisfactory color was found.

An electrician was employed from March 15 to June 30, 1902, to care for the electrical plants.

Money statement.

July 1, 1901, amount unexpended	$441.70
March 5, 1902, amount allotted for pay of electrician	750.00
	1,191.70
June 30, 1902, amount expended during fiscal year	638.00
July 1, 1902, balance unexpended and available	553.70

Supplies for seacoast defenses.—The amount available for this purpose at the beginning of the fiscal year was $402.80. It was drawn upon for filling requisitions submitted by the acting engineer officers of posts and approved by the Chief of Engineers.

Money statement.

July 1, 1901, amount unexpended	$402.80
June 30, 1902, amount expended during fiscal year	332.73
July 1, 1902, balance unexpended and available	70.07

2 P.

DEFENSES OF PENSACOLA, FLORIDA.

Officers in charge, Capt. William V. Judson, Corps of Engineers, until November 4, 1901, and Lieut. Robert R. Raymond, Corps of Engineers, since that date; Division Engineers, Col. Peter C. Hains, Corps of Engineers, until July 24, 1901, and Lieut. Col. Henry M. Adams, Corps of Engineers, since that date.

Installation of searchlight.—This work is described in the last Annual Report of the Chief of Engineers, and was completed at the beginning of the fiscal year. The only operations during the year were the settlement of outstanding liabilities. An allotment of $1,500 was made by the Chief of Engineers, United States Army, for this work, on March 22, 1901, from the appropriation for "Gun and Mortar Batteries," act of March 1, 1901.

Money statement.

July 1, 1901, balance unexpended	$473.81
June 30, 1902, amount expended during fiscal year	473.81

Communicating gallery, 10-inch battery.—This work consists of a concrete-steel gallery connecting the four loading platforms of the battery.

An allotment of $1,600 was made for this work on February 2, 1901, from the appropriation for "Gun and Mortar Batteries," act of May 25, 1901.

At the beginning of the fiscal year work had been begun, and during the year it was completed.

Money statement.

July 1, 1901, balance unexpended	$1,393.73
June 30, 1902, amount expended during fiscal year	1,393.73

Communicating gallery, 8-inch battery.—This work consists of a concrete-steel gallery connecting the two loading platforms of the battery.

An allotment of $700 was made for this work on February 15, 1901, from the appropriation for "Gun and Mortar Batteries," acts of May 7, 1898 ($498.12), and March 3, 1899 ($201.88).

At the beginning of the fiscal year work had been begun and during the year it was completed.

Money statement.

July 1, 1901, balance unexpended	$657.13
June 30, 1902, amount expended during fiscal year	657.13

Mortar battery.—This battery consists of emplacements for eight 12-inch mortars.

An allotment of $500 was made on February 28, 1901, from the appropriation for "Gun and Mortar Batteries," act of May 25, 1900, for removing and storing track, gravel, and storage bins at the battery, and for construction of boathouse for naphtha launch.

At the beginning of the fiscal year the battery was complete, the removal and storing of plant remaining. During the year all work was completed.

Money statement.

July 1, 1901, balance unexpended	$63.09
June 30, 1902, amount expended during fiscal year	63.09

Fire commander's station.—An allotment of $150 was made on August 28, 1900, from the appropriation for "Gun and Mortar Batteries," act of July 7, 1898, for the construction of this station.

At the beginning of the fiscal year plans were partially prepared, but were held in abeyance pending decision as to a change of dimensions. During the year the funds on hand were deposited to the credit of the United States Treasurer.

Money statement.

July 1, 1901, balance unexpended	$50.00
June 30, 1902, amount deposited to credit of the Treasurer, United States.	50.00

Electric wiring.—This work consists of a system of aerial conductors leading from the power plant to and about the post for lighting purposes.

The following allotments have been made for this work from appropriations for "Gun and Mortar Batteries:"

May 18, 1901, act of March 1, 1901	$1,600.00
May 25, 1901, act of March 1, 1901	700.00
	2,300.00

At the beginning of the fiscal year proposals for doing the work had been solicited. During the year an emergency contract was entered into with the West Electric Company, of Montgomery, Ala., and the work was completed.

Money statement.

July 1, 1901, balance unexpended	$2,300.00
June 30, 1902, amount expended during fiscal year	1,953.18
July 1, 1902, balance unexpended	346.82
July 1, 1902, outstanding liabilities (under contract)	346.82

Doors for magazines, etc., 12-inch and 10-inch batteries.—An allotment of $625 was made for this work on May 7, 1901, from the appropriation for "Gun and Mortar Batteries," act of March 1, 1901.

At the beginning of the fiscal year doors had been hung at magazine No. 1, 12-inch battery. During the year arrangements have been made for the manufacture of the remaining doors.

Money statement.

July 1, 1901, balance unexpended	$603.20
June 30, 1902, amount expended during fiscal year	207.39
July 1, 1902, balance unexpended	395.81
July 1, 1902, outstanding liabilities	376.33
July 1, 1902, balance available	19.48

Installation of range and position finders.—The following allotments have been made from appropriation for "Gun and Mortar Batteries:"

July 18, 1901, act of May 25, 1900	$50.00
September 23, 1901, act of May 25, 1900	150.00
November 30, 1901, act of May 25, 1900	150.00
March 15, 1902, act of July 7, 1898	300.00
March 26, 1902, act of March 1, 1901	8,547.00
May 29, 1902, act of July 7, 1898	150.00
	9,347.00

An allotment of $8,771.60 was made April 29, 1902, by the Board of Ordnance and Fortification for the construction of the temporary portions of the stations of an experimental system of range and position finding.

At the beginning of the fiscal year nothing had been done. During the year eight bases for Rafferty range finders were placed upon the different batteries. By telegram dated May 21, 1902, the Chief of Engineers authorized the expenditure of $150, allotted for the removal of a range-finder station at another locality, upon the construction of shelters for type B instruments, the former work being no longer necessary in view of the establishment of an experimental system.

The shelters were constructed during the year.

The experimental system consists of 12 stations, each being a temporary wooden tower containing an instrument mounted on a permanent concrete pier. The exact positions of these stations were determined by triangulation.

Money statement.

Amount allotted during fiscal year by the Chief of Engineers	$9,347.00
Amount allotted during fiscal year by the Board of Ordnance and Fortification	8,771.60
	18,118.60
June 30, 1902, amount expended during fiscal year	3,314.70
July 1, 1902, balance unexpended	14,803.90
July 1, 1902, outstanding liabilities	3,518.76
July 1, 1902, balance available	11,285.14

Transporting plant.—This transportation consisted in returning to the Coosa River works the plant which had been borrowed therefrom for use on fortifications.

The following allotments have been made from the appropriation for "Gun and Mortar Batteries:"

August 12, 1901, act of May 25, 1900	$200.00
December 27, 1901, act of May 25, 1900	51.97
	251.97

Money statement.

Amount allotted during fiscal year	$251.97
June 30, 1902, amount expended during fiscal year	251.97

Guide rails for ammunition trucks, 12-inch battery.—This work consisted in making certain alterations to delivery tables of the ammunition lifts, and so placing guide rails upon the loading platforms as to facilitate the rapid and accurate placing of ammunition trucks to receive their loads from the lifts.

An allotment of $30 was made for this work on October 3, 1901, from appropriation for "Gun and Mortar Batteries," act of March 3, 1899.

During the year the work was completed.

Money statement.

Amount allotted during fiscal year	$30.00
June 30, 1902, amount expended during fiscal year	30.00

Rewiring 10-inch and 12-inch batteries.—This work involves the removal of the present electric wiring and the construction of new wiring inclosed in a steam-tight conduit system of nickel.

An allotment of $2,000 was made for this work on June 11, 1902, from appropriation for "Gun and Mortar Batteries."

During the year no work has been done. Correspondence with manufacturers of nickel pipe has been entered into to secure necessary data for compiling bills of material.

Money statement.

Amount allotted during fiscal year	$2,000.00
July 1, 1902, balance unexpended and available	2,000.00

Doors for magazines, etc., 8-inch battery.—An allotment of $275 was made for this work on May 7, 1901, from appropriation for "Gun and Mortar Batteries," act of March 1, 1901.

During the year arrangements have been made for the manufacture of the required doors.

Money statement.

July 1, 1901, balance unexpended	$275.00
June 30, 1902, amount expended during fiscal year	38.76
July 1, 1902, balance unexpended	236.24
July 1, 1902, outstanding liabilities	168.67
July 1, 1902, balance available	67.57

Preservation and repair of fortifications.—Repairs to 8-inch battery: One of the boilers of the electric plant was retubed throughout, the slopes were repaired where injured by cattle, and all ironwork was repainted.

Repairs to 3-inch battery: The surfaces surrounding this battery (620 squares) have been sodded and planted with Bermuda grass roots

to prevent the shifting of the sand by the wind. The work is entirely successful and improves the appearance of the battery. The shore in rear of this battery was protected from erosion by a small concrete sea wall 644 feet in length. The parapet slopes were repaired where injured by cattle.

Repairs to mortar battery: A flight of concrete steps was provided to prevent damage to the slopes by the detachments at drill. The foundations of the water-supply pump were rebuilt. The floors of the four guardrooms were raised 2 inches for drainage purposes.

Repairs to the 12-inch battery: A recess was cut in the wall of the boiler room to give access to the end of the boiler. Several tubes of the boiler were replaced and others repaired. The dynamo room, storage-battery room, and magazines of emplacement No. 1 were lined with brick walls and lead ceilings and the floors were raised 2 inches. Moisture was led from the spaces between old and new works by drains. These rooms, originally very wet, were thus made dry. (See Appendix Z Z 6.) The floor of the passage in emplacement No. 1 was raised 2 inches. The ironwork was also repainted.

Repairs to the 10-inch battery: In emplacements Nos. 3 and 4 the magazines were lined as described in the preceding report. The ironwork was repainted.

Repairs to the 4.7-inch battery: The anchorages of the gun mounts were repaired (see Appendix Z Z 6) and all ironwork was repainted.

Money statement.

July 1, 1902, balance unexpended	$7,711.49
Amount allotted during fiscal year	4,670.00
	12,381.49
June 30, 1902, amount expended during fiscal year	9,717.87
July 1, 1902, balance unexpended	2,663.62
July 1, 1902, outstanding liabilities	94.36
July 1, 1902, balance available	2,569.26

Installation of range and position finders.—This work consists in the construction of the temporary portions of stations of an experimental system of position finders.

An allotment of $8,771.60 was made for this work April 5, 1902, by the Board of Ordnance and Fortification.

The operations during the year have been described in the report upon the installation of range and position finders under the appropriation for "Gun and Mortar Batteries."

Money statement.

Amount allotted during fiscal year	$8,771.60
June 30, 1902, amount expended during fiscal year	942.60
July 1, 1902, balance unexpended	7,829.00
July 1, 1902, outstanding liabilities	2,426.04
July 1, 1902, balance available	5,402.96

Supplies for seacoast defenses.—From time to time electrical supplies were furnished on approved requisitions submitted by the acting engineer officer.

Money statement.

July 1, 1901, balance unexpended	$483.00
Amount allotted during fiscal year	587.00
	1,070.00
June 30, 1902, amount expended during fiscal year	1,054.83
July 1, 1902, balance unexpended	15.17
July 1, 1902, outstanding liabilities	15.17

Construction of offices and storerooms.—Allotments amounting to $700 were made from appropriation for "Supplies for Seacoast Defenses," act of March 1, 1901, for two buildings to be used as offices and storerooms.

During the year the work was completed, the buildings being for the use of the electrician sergeants.

Money statement.

Amount allotted during fiscal year	$700.00
June 30, 1902, amount expended during fiscal year	700.00

Water supply.—This work consisted in connecting the boiler rooms of the 10-inch and 12-inch batteries with the post water supply.

An allotment of $275 was made on October 4, 1901, from the appropriation for "Supplies for Seacoast Defenses," act of May 25, 1900. During the year the work was completed.

Money statement.

Amount allotted during fiscal year	$275.00
June 30, 1902, amount expended during fiscal year	275.00

Coal sheds.—During the year two coal sheds were built for the electric plants at the 10-inch and 12-inch batteries.

An allotment of $175 was made for this work on December 27, 1901, from the appropriation for "Supplies for Seacoast Defenses," act of March 1, 1901.

Money statement.

Amount allotted during fiscal year	$175.00
June 30, 1902, amount expended during fiscal year	175.00

2 Q.

DEFENSES OF MOBILE AND OF MISSISSIPPI SOUND.

Officers in charge, Maj. William T. Rossell, Corps of Engineers, until September 9, 1901, and Capt. Spencer Cosby, Corps of Engineers, since that date; Division Engineers, Col. Peter C. Hains, Corps of Engineers, until July 24, 1901, and Lieut. Col. Henry M. Adams, Corps of Engineers, since that date.

SITE NO. 1.

Mortar battery.—The approved project provided originally for the construction of a battery for eight 12-inch B. L. steel mortars at an

estimated cost of $140,000. This was subsequently increased by $15,000, of which $2,000 was afterwards withdrawn.

At the beginning of the fiscal year the battery was completed except for a few minor details. It was transferred to the artillery on May 20, 1901. The carriages had then all been assembled to the height of the loading platforms. The work of assembling the balance of the carriages and mounting the guns was assigned to the artillery.

A detailed account of the progress of work on this battery is contained in the Annual Reports of the Chief of Engineers for 1899, 1900, and 1901.

During the fiscal year the wood and iron work and fences were painted, the sodded slopes cared for, the toe of the exterior slopes protected from the effects of heavy rains by embedding brush therein, the drainage at mortar pits improved, and the plant cared for.

Of the eight mortars, four were received on January 10, 1902, and four on January 23, 1902. They are not yet mounted.

On the night of July 3, 1901, the covering of the west flank traverse slid into the pit, breaking down the concrete cornice along the whole face of the wall. The covering consisted of sand resting on a 4-inch layer of concrete overlying the asphalt waterproofing, which was on a slope of 1 on 21. The concrete under the pressure of the sand slid on the asphalt, the retaining cornice giving way under the pressure. On October 11, 1901, the same thing happened to the central traverse on the opposite side of the pit.

To prevent the occurrence of similar accidents in other parts of the battery, the layers of concrete overlying the waterproofing were anchored to the concrete underneath by means of 155 1¼-inch bolts spaced 2 feet apart. The covering was thus relieved from the greater part of the pressure against it.

The broken cornice was replaced by one having a much greater cross section, well anchored by dowels, 70 cubic yards of 1 : 3 : 6 concrete being used for the purpose. The damaged asphalt was removed and a new waterproof course of asphalt mastic applied after a series of tests had been made. The sand covering was replaced and the slopes were graded and resodded, about 2,400 cubic yards of material being removed; most of this had to be handled twice. Repairs were also made to downspouts, drains, speaking-tube system, etc., injured by the cave-in.

These repairs were made under an allotment of $4,500 from the appropriation for "Preservation and Repair of Fortifications."

Under an allotment of $150 from the appropriation for "Preservation and Repair of Fortifications," light interior doors were installed at the entrance of each powder magazine and at the fan openings, to reduce the condensation of moisture.

Battery for two 12-inch breech-loading rifles.—This battery was completed in 1900, except for the mounting of the guns, which is now being done by the garrison. It was transferred to the artillery on June 8, 1900.

A detailed report of the progress of the work is contained in the Annual Reports of the Chief of Engineers for 1898 to 1901, inclusive. Both carriages are assembled and one gun is practically mounted.

The following work was done on the battery during the fiscal year under allotments from appropriation for "Preservation and Repair of Fortifications:"

Exudations of the asphalt waterproofing at several places in the battery were effectually stopped by a pointing of 1:1 Portland-cement mortar well rammed into a dovetailed groove about 2 inches in depth cut along the seam from which the asphalt exuded. By order of the Chief of Engineers the service for supplying ammunition was tested and considerable experimental work done thereon, the results of which were duly reported. The principal changes made in consequence were in the ammunition truck guides and in the escapement and other parts of the delivery table of the chain hoists.

Battery for four 8-inch breech-loading rifles.—This battery was completed and the guns and carriages were mounted in 1898. It was transferred to the artillery on September 28, 1898.

A detailed account of the progress of the work is contained in the Annual Reports of the Chief of Engineers for 1895 to 1899, inclusive.

On July 3, 1901, the Chief of Engineers allotted the sum of $2,000 from the appropriation for "Gun and Mortar Batteries" for the construction of a bracket gallery along the rear of the battery to connect the four platforms.

The gallery is 4 feet in width and is built of steel I-beams, channel beams, and checkered floor plates, together with the usual connections and fittings for hand rails. It is of the cantiliver type. The supporting I-beams are 10 feet apart, with bearing plates beneath, and are let into the concrete about 3 feet.

Each gallery was designed to permit the passage of loaded ammunition trucks with their detail, if desirable.

Work under this allotment was practically completed on January 1, 1902, but owing to delay of the manufacturers in supplying a few minor fittings for hand rails the work was not entirely completed until April, 1902. The balance of funds, amounting to $26.75, was deposited to the credit of the appropriation during May, 1902.

The following work was done on the battery during the fiscal year under allotments from appropriations for "Preservation and Repair of Fortifications:"

Seven hundred and twenty trees were planted along the rear and flanks for the purpose of masking the battery. Slight repairs were made to the fence inclosing the battery and to the electric plant. Considerable waterproofing was applied to correct dampness in some of the rooms, and a waterproof lining, which has proved very satisfactory, was installed in the magazine of emplacement No. 3.

Battery for two 4.7-inch rapid-fire guns.—This battery was partially completed and the guns were mounted on May 9, 1898. It was completed in all its details and transferred to the artillery on February 17, 1899. The project for its construction and the progress of the work are shown in the Annual Reports of the Chief of Engineers for 1898 and 1899.

The work done on this battery during the fiscal year was under allotment from the appropriation for "Preservation and Repair of Fortifications." A few damp spots in the magazines were corrected by waterproofing, the wood and iron work was painted, and the sodded slopes were cared for.

Emplacements for two 3-inch rapid-fire guns.—This battery was completed and transferred to the artillery on June 8, 1900. No guns or carriages have yet been received. An account of the progress of

the work is contained in the Annual Reports of the Chief of Engineers for 1899 and 1900.

Under allotment from the appropriation for "Preservation and Repair of Fortifications" the wood and iron work was painted, the sodded slopes were cared for, and a small amount of waterproofing was done during the fiscal year.

Concrete cable tank.—This was completed in November, 1897, and transferred to the artillery on June 13, 1901.

During the fiscal year the windmill pumping plant was kept in repair under allotment for preservation and repair of fortifications.

Old brick fort.—The entrances to two of the casemates were boarded up in order that they might serve as storerooms for submarine mining material, and the dry ditch was cleaned. This work was done under allotment for preservation and repair of fortifications.

Installation of range and position finders.—On August 28, 1901, the Chief of Engineers allotted $110 from the appropriation for "Gun and Mortar Batteries" for setting bases for Rafferty range finders.

Under this allotment cast-iron bases, made of 8-inch water pipe, embedded in the concrete, were installed at the 8-inch and mortar batteries. At the 12-inch battery a wooden structure was erected on the site of the astronomical station once used by the Coast and Geodetic Survey.

Battery commander's station.—The allotment of $6,000 for constructing a battery commander's station for the 12-inch battery was withdrawn by the Chief of Engineers on October 23, 1901.

Preservation and repair of fortifications.—At the beginning of the fiscal year there was a balance unexpended of allotments previously made amounting to $2,533.45.

Mention has already been made of much of the work carried on during the year under various allotments from this appropriation. In addition, the following work was done:

A survey was made of the eastern boundary of the reservation, and slight repairs were made to sea wall, wharves, and office building. The plant was cared for, brass number plates were placed on all the battery doors, and the keys were provided with brass tags.

During the storm of August 15, 1901, a portion of the mess hall was blown from its foundation and practically collapsed. Two other buildings were partially unroofed. These with other damages were repaired under an allotment of $615, made September 16, 1901, for the purpose.

Peace storage magazine.—On October 16, 1901, an allotment of $7,000 was made by the Chief of Engineers for the construction of a peace storage magazine. The amount was increased by $350 on February 12, 1902, to provide for the substitution of a copper roof for one of slate.

The magazine is being built under emergency contract, in accordance with the plans and specifications of The Board of Engineers, but has three doors and is lower than the type magazine. The contract price, including a copper roof, is $6,850.

Work was begun by the contractor at the site of the building on January 31, 1902. At the end of the fiscal year work was nearly completed, only a few minor details remaining to be done.

Money statements.

GUN AND MORTAR BATTERIES.

Mortar battery.

July 1, 1901, balance unexpended		$2,732.80
June 30, 1902, amount expended during fiscal year		2,050.49
July 1, 1902, balance unexpended		682.31
July 1, 1902, outstanding liabilities		150.00
July 1, 1902, balance available		532.31

Battery commander's station.

July 1, 1901, balance unexpended		$6,000.00
October 25, 1901, amount withdrawn	$5,500.00	
October 28, 1901, amount turned back into Treasury	500.00	
		6,000.00

Installation of range and position finders.

August 28, 1901, amount allotted	$110.00
June 30, 1902, amount expended during fiscal year	110.00

Bracket gallery for 8-inch battery.

July 3, 1901, amount allotted		$2,000.00
June 30, 1902, amount expended during fiscal year	$1,973.25	
May 15, 1902, amount turned back into Treasury	26.75	
		2,000.00

Peace storage magazine.

October 16, 1901, amount allotted		$7,000.00
February 12, 1902, amount allotted		350.00
		7,350.00
June 30, 1902, amount expended during fiscal year		5,058.73
July 1, 1902, balance unexpended		2,291.27
July 1, 1902, outstanding liabilities	$1,863.74	
July 1, 1902, amount covered by uncompleted contracts	226.00	
		2,089.74
July 1, 1902, balance available		201.53

Erecting latrines and extending water-supply system.

June 23, 1902, amount allotted	$3,725.00
July 1, 1902, balance available	3,725.00

PRESERVATION AND REPAIR OF FORTIFICATIONS.

Miscellaneous repairs.

July 1, 1901, balance unexpended		$2,523.08
September 16, 1901, amount allotted		615.00
		3,138.08
June 30, 1902, amount expended during fiscal year		2,516.45
July 1, 1902, balance unexpended		621.63
July 1, 1902, outstanding liabilities		100.00
July 1, 1902, balance available		521.63

Repair of mortar battery.

September 3, 1901, amount allotted	$4,500.00
June 30, 1902, amount expended during fiscal year	4,500.00

Interior magazine doors.

September 9, 1901, amount allotted	$150.00
June 30, 1902, amount expended during fiscal year	150.00

Care of torpedo material.

July 1, 1901, balance unexpended	$0.60
August 24, 1901, amount turned back into Treasury	.60

Care of submarine-mine material.

July 1, 1901, balance unexpended		$9.77
June 30, 1902, amount expended during fiscal year	$5.47	
November 16, 1901, amount turned back into Treasury	4.30	
		9.77

Contracts in force.

With the Fonde Building Company, dated January 27, 1902 (emergency contract, not approved by Chief of Engineers), for erecting and completing a storage magazine; amount of contract, $6,500. Work was commenced January 31, 1902; to be completed by July 31, 1902.

Supplemental contract with the Fonde Building Company, dated February 17, 1902, approved by the Chief of Engineers March 25, 1902, for roofing the storage magazine with copper instead of slate, at an additional cost of $350.

SITE NO. 2.

Battery for two 8-inch B. L. rifles.—This battery was completed in 1899 and was transferred to the artillery on August 19, 1899.

During the fiscal year a few minor repairs were made to the drainage system under allotment for preservation and repair of fortifications.

Emplacements for two 6-inch rapid-fire guns.—At the beginning of the fiscal year this battery was practically completed; it had been transferred to the artillery on May 20, 1901. An account of the progress of the work is contained in the Annual Reports of the Chief of Engineers for 1900 and 1901.

During the fiscal year the small balance of funds available was applied to completing the system of drainage, installing copper hoods for doors and windows, caring for sodded slopes, cleaning up the grounds in the immediate vicinity, improving ventilation in boiler room, stopping exudation of asphalt waterproofing from the walls in a few places, and caring for the plant.

On June 10, 1901, an allotment of $750 was made by the Chief of Engineers from the appropriation for "Gun and Motar Batteries" for mounting the carriages, both of which had been received.

The work of mounting the carriages was begun on July 15, 1901. The plant used consisted of two lines of trestle work, supporting a traveling car from which was suspended a 10-ton chain block. On August 6, 1901, the carriage at emplacement No. 2 was entirely assembled and that at emplacement No. 1 on August 21, 1901.

Both carriages when assembled could be traversed very easily, one man beihg able to traverse either by simply pushing against it. Two mechanics furnished by the Ordnance Department assisted in the work.

The balance of funds, amounting to $93.24, was deposited to the credit of the appropriation during October, 1901.

Under allotment for preservation and repair of fortifications a small amount of work was done in painting iron and wood work, caring for slopes, etc.

Emplacements for two 3-inch rapid-fire guns.—At the beginning of the fiscal year this battery was practically completed, and had been transferred to the artillery on May 20, 1901. The guns and carriages have not yet been received. A detailed report of the construction will be found in the Annual Report of the Chief of Engineers for 1901.

During the year the small unexpended balance was exhausted in caring for the sodded slopes and drains, grading, and protecting the ground adjacent to the right flank against washouts, placing filling in front of battery to protect the toe of sodded slopes, taking inventory of and caring for United States property, and purchasing a few supplies.

Under allotment for preservation and repair of fortifications a small amount of work was done, consisting of painting wood and iron work and repairing fences inclosing battery.

During the fiscal year the windmill pumping plant, used for pumping out dry ditch, was repaired and the ditch cleaned, under allotment for preservation and repair of fortifications.

Preservation and repair of fortifications.—At the beginning of the fiscal year there was a balance unexpended of allotments previously made, amounting to $1,031.75.

Mention has already been made of much of the work carried on during the year under allotments from this appropriation. In addition, the following work was done: The causeway of wharf, windmill pumping plant in old fort, etc., damaged by storm of August 15, 1901, were repaired under allotment of $315 made for that purpose on September 16, 1901.

SEA WALLS AND EMBANKMENTS.

A riprap sea wall, 235 feet long, including riprap ending, was constructed in front of the 3-inch battery, where erosion was taking place. Work was begun July 19, 1901, and completed August 24, 1901. In this wall 626⅔ square yards of fascine mattress and 419½ cubic yards of stone were used.

By the storm of August 15, 1901, about 200 feet of the sea wall in front of the old fort was practically leveled, while other portions were more or less damaged. These were repaired as far as possible under an unexpended balance of allotment, amounting to $792.31.

SUPPLIES FOR SEACOAST DEFENSES.

Materials called for on requisitions of the acting engineer officers, duly approved by the Chief of Engineers, were purchased and transferred.

One voltmeter was calibrated for the electric plant of the mortar battery at site No. 1.

Money statements.

GUN AND MORTAR BATTERIES.

Emplacements for two 6-inch rapid-fire guns.

July 1, 1901, balance unexpended		$507.64
June 30, 1902, amount expended during fiscal year		507.64

Mounting gun carriages on 6-inch emplacements.

July 1, 1901, balance unexpended		750.00
June 30, 1902, amount expended during fiscal year	$656.76	
October 30, 1901, amount turned back into Treasury	93.24	
		750.00

Emplacements for two 3-inch rapid-fire guns.

July 1, 1901, balance unexpended	$474.18
June 30, 1902, amount expended during fiscal year	474.18

PRESERVATION AND REPAIR OF FORTIFICATIONS.

July 1, 1901, balance unexpended	$1,031.75
September 16, 1901, amount allotted	315.00
	1,346.75
June 30, 1902, amount expended during fiscal year	900.53
July 1, 1902, balance unexpended	446.22
July 1, 1902, outstanding liabilities	20.00
July 1, 1902, balance available	426.22

SEA WALLS AND EMBANKMENTS.

July 1, 1901, balance unexpended	$2,944.98
June 30, 1902, amount expended during fiscal year	2,944.98

SUPPLIES FOR SEACOAST DEFENSES.

July 1, 1901, balance unexpended	$513.71
January 25, 1902, amount allotted	300.00
	813.71
June 30, 1902, amount expended during fiscal year	647.60
July 1, 1902, balance unexpended	166.11

2 R.

DEFENSES OF NEW ORLEANS, LOUISIANA, AND OF SABINE PASS, TEXAS.

Officers in charge, Lieut. Edward M. Adams, Corps of Engineers, in temporary charge until October 6, 1901, and Lieut. Col. Henry M. Adams, Corps of Engineers, in charge since that date; assistants, Lieut. Edward M. Adams, Corps of Engineers, from October 6, 1901, to December 13, 1901, and Lieut. Paul S. Bond, Corps of Engineers, since March 19, 1902.

NEW ORLEANS, LOUISIANA.

SITE NO. 1.

Emplacements for two 3-inch rapid-fire guns on balanced-pillar mounts, second battery.—Funds for the construction of this battery were allotted June 16, 1900. Work was commenced June 25, 1900, and in September, 1900, the emplacements were practically completed. The bottom castings for the mounts remain to be set in the concrete to complete the work. These castings have not been received from the Ordnance Department. The sum of $9,708.28 has been expended on this work.

Money statement.

July 1, 1901, balance unexpended	$291.72
July 1, 1902, balance unexpended and available	291.72

Emplacements for four 6-inch rapid-fire guns on pedestal mounts.—An allotment of $340 was made April 27, 1901, for preparation of plans and for making borings at the site of proposed battery. Plans and estimates were approved May 17, 1901. Funds for the construction of this battery were provided by an allotment of $80,000, made May 17, 1901, from the appropriation for "Gun and Mortar Batteries." Work of constructing two of the emplacements was commenced June 10, 1901, the construction of the other two emplacements being deferred until title to the site could be procured.

At the end of November, 1901, the foundation for two emplacements was completed at a cost of $12,397.57. Concrete work was commenced November 21, 1901, and completed May 13, 1902. The two emplacements contain 2,670 cubic yards of concrete.

Electric lights and switchboards were placed in the magazines.

The concrete work in the two emplacements was completed at the end of the fiscal year; cost, $46,973.08. The ammunition lifts, exterior conduits for electric wires, and earth protection remain to be completed.

The site for the second two emplacements was acquired by purchase July 7, 1902, under judgment rendered April 19, 1902, in expropriation proceedings against the owners. Materials for the battery are being ordered and work will commence in August, 1902.

Money statement.

July 1, 1901, balance unexpended	$79,666.70
June 30, 1902, amount expended during fiscal year	46,299.79
July 1, 1902, balance unexpended	33,366.91
July 1, 1902, outstanding liabilities	272.90
July 1, 1902, balance available	33,094.01

Range-finder tower.—Allotments aggregating $13.500 were made during the year from appropriation for "Gun and Mortar Batteries" for construction of a fire commander's station.

Work on the foundation was commenced in December, 1901, and completed in April, 1902.

The foundation consists of piles and grillage inclosed by 12 by 12 inch sheet piling, strengthened on the inside and outside by waling.

Concrete work was commenced April 10 and completed April 26, 1902, except the steps, which were completed in May.

The foundation and concrete column were built by hired labor; cost, $8,829.04. The work of erecting the steel tower is being done under contract; the cost will be $4,563. It is expected the tower will be completed in August, 1902.

Money statement.

December 6, 1901, amount allotted		$11,500.00
January 29, 1902, amount allotted		2,000.00
		13,500.00
June 30, 1902, amount expended during fiscal year		8,829.04
July 1, 1902, balance unexpended		4,670.96
July 1, 1902, outstanding liabilities	$38.74	
July 1, 1902, amount covered by existing contracts	4,563.00	
		4,601.74
July 1, 1902, balance available		69.22

Releveling base rings of 10-inch platforms.—Allotments aggregating $2,885 were made August 22 and December 13, 1901, for this purpose from the appropriation for "Gun and Mortar Batteries." The dismounting of the carriages from the emplacements was completed by the artillery troops on November 22. The concrete platforms were then cut out sufficiently to permit the removal of the anchor bolts. The bolts were rethreaded and reset, the concrete rebuilt around them, and base rings mounted and reset. The old 10-inch carriages were shipped away by the post commander, and new carriages were received to take their place. The work of releveling the base rings was completed in February, 1902, after the arrival of the new base rings.

Money statement.

August 22, 1901, amount allotted	$330.00
December 13, 1901, amount allotted	2,555.00
	2,885.00
June 30, 1902, amount expended during fiscal year	2,885.00

Sites for fortifications.—On December 8, 1900, $250 was allotted from the appropriation for "Sites for Fortifications and Seacoast Defenses" for the purchase of a tract of land adjoining the present reservation, to be used as a site for emplacements for 6-inch rapid-fire guns. Additional sums of $225.10 and $40 were allotted from the same appropriation for this purpose on April 26 and June 30, 1902, respectively. Upon the report of the United States district attorney at New Orleans, the Attorney-General stated that the owner of the land could not convey an acceptable title. Expropriation proceedings were accordingly instituted, and a judgment rendered on April 19, 1902, awarding the land to the United States for the sum of $300 and costs of court. The title granted by the court was approved by the Acting Attorney-General on June 7, and authority granted by the Secretary of War June 27 to pay the amount of the award. Payment was made on July 7.

Money statement.

December 8, 1900, amount allotted	$250.00
April 26, 1902, amount allotted	225.10
June 30, 1902, amount allotted	40.00
July 1, 1902, balance unexpended	515.10
July 1, 1902, outstanding liabilities	505.10
July 1, 1902, balance available	10.00

Construction of levee.—On April 24, 1901, an allotment of $2,400 was made from the appropriation for "Sea Walls and Embankments," act of March 1, 1901, to be applied to repairing and raising the front levee on the river side of the reservation. This amount was supplemented September 5, 1901, by an allotment of $2,400 from the appropriation for "Preservation and Repair of Fortifications," act of March 1, 1901.

At the beginning of the past fiscal year the land outside of the levee had been drained and cleared of drift.

The work was nearing completion when a severe storm, on August 13–15, washed away about 300 feet of the old levee, damaged 800 feet more, and piled a large amount of drift on the batture. It became necessary to build a protection levee along the banks and to use pumps in order to secure earth.

With the allotment of $2,400 made September 5, 1901, the levee was rebuilt and a board revetment constructed to protect 1,080 feet of the new levee from action of the waves. The levee was completed October 31, 1901; the revetment February 26, 1902.

Money statement.

July 1, 1901, balance unexpended	$2,325.00
September 5, 1901, amount allotted	2,400.00
	4,725.00
June 30, 1902, amount expended during fiscal year	4,725.00

Preservation and repair of fortifications.—On May 20, 1901, an allotment of $1,500 was made to be applied to the fortifications at this locality during the fiscal year ending June 30, 1902. This amount was supplemented by an allotment of $90 on May 23, 1902, for repairs to hand rails of the 10-inch gun battery.

During the past fiscal year the wooden steps of the 8-inch battery were replaced by concrete steps, quarters and wharf were repaired, a tile drain provided for the magazine of the 4.7-inch rapid-fire gun battery, trolley beams and doors of the 10-inch battery were repaired, the magazines were whitewashed, and the ironwork of the batteries was painted. The hand rails of the 10-inch battery, which had been removed by the artillery in mounting new carriages, were repaired from June 2 to 25, 1902.

See also report on construction of levee.

Money statement.

May 20, 1901, amount allotted	$1,500.00
May 23, 1902, amount allotted	90.00
	1,590.00
June 30, 1902, amount expended during fiscal year	1,538.70
July 1, 1902, balance unexpended	51.30
July 1, 1902, outstanding liabilities	51.30

SITE NO. 2.

Preservation and repair of fortifications.—On May 20, 1901, the sum of $1,000 was allotted for miscellaneous repairs at this locality during the fiscal year ending June 30, 1902.

On June 5, 1901, an allotment of $90 was made for the hire of a watchman to care for the torpedo property. On July 27 and October 21, 1901, additional allotments of $180 each were made for the same purpose.

Two watchmen were employed from the beginning of the fiscal year to November 6, 1901, when the torpedo property was transferred to the artillery.

Repairs were made to one of the buildings, magazines of the batteries were whitewashed, repairs were made to the loading platform of the 8-inch battery, and the bridges leading to the old brick fort were repaired. The casemate used for the dynamo plant was rendered dry by removing the earth protection and coating the exterior with asphalt. The ironwork of the batteries was painted and other minor repairs made.

Money statement.

July 1, 1901, amount unexpended		$1,090.00
July 27, 1901, amount allotted		180.00
October 21, 1901, amount allotted		180.00
		1,450.00
December 21, 1901, repayment to appropriation	$128.24	
June 30, 1902, amount expended during fiscal year	1,215.20	
		1,343.44
July 1, 1902, balance unexpended		106.56
July 1, 1902, outstanding liabilities		106.56

SUPPLIES FOR SEACOAST DEFENSES.

On June 7, 1900, an allotment of $500 was made from this appropriation, act of May 25, 1900, for the purchase of electrical supplies for use of the artillery, on requisitions duly approved by the Chief of Engineers. During the fiscal year ending June 30, 1901, $369.38 was expended on such supplies. The allotment of June 7, 1900, was supplemented on September 23, 1901, by one of $500 from the act of March 1, 1901, for the same purposes. Three requisitions were filled during the past fiscal year. A reflector for searchlight, costing $200, was purchased and issued to the artillery January 27, 1902.

Injector and draft doors were applied to dynamo boiler and furnace.

Money statement.

July 1, 1901, balance unexpended	$130.32
September 23, 1901, amount allotted	500.00
	630.32
June 30, 1902, amount expended during fiscal year	254.97
July 1, 1902, balance unexpended and available	375.35

SABINE PASS, TEXAS.

No fortification work was done at this locality during the fiscal year. No funds were available.

Three thousand cubic yards of sand have been placed around the battery for foundation for concrete and sheet piling. Driving of sheet piling was commenced May 24, 1902, and completed June 10, 1902.

One hundred cubic yards of riprap have been placed on inside of sheet piling. Grouting under the battery is underway, and 57.79 tons of small riprap for revetment have been unloaded.

Money statement.

Amount allotted from act of March 1, 1901		$35,000.00
Amount expended on present project to end of last fiscal year		600.00
July 1, 1901, balance unexpended		34,400.00
June 30, 1902, amount expended during fiscal year		7,857.69
July 1, 1902, balance unexpended		26,542.31
July 1, 1902, outstanding liabilities	$1,393.63	
July 1, 1902, covered by uncompleted contracts	6,625.82	
		8,019.45
July 1, 1902, balance available		18,522.86

Reconstruction of mining casemate in traverse of 3-inch battery.—This casemate is being constructed by hired labor. Railway communication reached the site of this work on April 7, 1902.

Three thousand cubic yards of sand have been placed for foundation. Driving of sheet piling and round piling for foundation and cableway was commenced June 11, and completed June 24, 1902.

Money statement.

Amount allotted from act of March 1, 1901		$8,000.00
July 1, 1901, balance unexpended		8,000.00
June 30, 1902, amount expended during fiscal year		3,110.40
July 1, 1902, balance unexpended		4,889.60
July 1, 1902, outstanding liabilities	$3,658.32	
July 1, 1902, covered by uncompleted contracts	928.42	
		4,586.74
July 1, 1902, balance available		302.86

Reconstruction of submarine-mine warehouse.—This warehouse was constructed by hired labor. Railway communication reached the site of this work on February 18, 1902. During the fiscal year the warehouse has been reconstructed and all submarine-mine material stored in it.

Money statement.

Amount allotted from act of March 1, 1901	$2,000.00
July 1, 1901, balance unexpended	2,000.00
June 30, 1902, amount expended during fiscal year	1,989.54
July 1, 1902, balance unexpended and available	10.46

Repair of cable tank.—This cable tank has been repaired by hired labor. Railway communication reached the site of this work on February 24, 1902.

During the fiscal year a building has been erected over the tank, the cable stored in tank, the tank cleaned out, and ends of cable suspended out of water.

A traveling crane will probably be installed during the coming year.

Money statement.

Amount allotted from act of March 1, 1901	$2,200.00
July 1, 1901, balance unexpended	2,200.00
June 30, 1902, amount expended during fiscal year	1,880.92
July 1, 1902, balance unexpended	319.08
July 1, 1902, outstanding liabilities	11.11
July 1, 1902, balance available	307.97

Reconstruction of tracks and wharf for submarine-mine service.—These tracks and wharf were constructed by hired labor. Railway communication reached the site of this work on December 3, 1901.

During the fiscal year tracks to the cable tank, to the gallery of the warehouse, and to the warehouse were completed. The wharf was completed, including tram track, hand rails, and inclines.

Money statement.

Amount allotted from act of March 1, 1901	$5,800.00
July 1, 1901, balance unexpended	5,800.00
June 30, 1902, amount expended during fiscal year	5,691.78
July 1, 1902, balance unexpended	108.22
July 1, 1902, outstanding liabilities	86.32
July 1, 1902, balance available	21.90

SITE NO. 2.

At the beginning of the fiscal year plans and estimates had been submitted for approval, materials had been received for repairing plant, and office and storeroom were being constructed.

Plans and estimates were received, approved, July 7, 1901, and active operations were at once commenced.

Repair of battery for two 10-inch guns on disappearing carriages.—This battery is being repaired by hired labor.

During the fiscal year all sheet piling has been driven. The riprap revetment has been one-half unloaded. Sand under the battery has been excavated, grouting under the battery completed, and space between sheet and foundation piles filled in with small riprap.

Money statement.

Amount allotted from act of March 1, 1901		$85,000.00
July 1, 1901, balance unexpended		85,000.00
June 30, 1902, amount expended during fiscal year		23,880.47
July 1, 1902, balance unexpended		61,119.53
July 1, 1902, outstanding liabilities	$12,459.83	
July 1, 1902, covered by uncompleted contracts	15,788.58	
		28,248.41
July 1, 1902, balance available		32,871.12

Repair of battery for eight 12-inch mortars.—This battery is being repaired by hired labor.

During the fiscal year all sheet piling and foundation piles for east and west wing walls have been driven, grout under the battery has

been completed, concrete between sheet piling and foundation piling has been finished on both ends and in front of battery and in rear, except in rear of each mortar pit.

The old east and west wing walls were destroyed and new ones constructed. West wing observation station was constructed. Riprap protection is about six-tenths completed; 11,016.47 tons have been unloaded and placed.

Money statement.

Amount allotted from act of March 1, 1901		$180,000.00
Amount expended on present project to end of last fiscal year		1,000.00
July 1, 1901, balance unexpended		179,000.00
June 30, 1902, amount expended during fiscal year		50,528.78
July 1, 1902, balance unexpended		128,471.22
July 1, 1902, outstanding liabilities	$9,627.57	
July 1, 1902, covered by uncompleted contracts	31,875.74	
		41,503.31
July 1, 1902, balance available		86,967.91

Repair of battery for two 3-inch rapid-fire guns.—This battery is being repaired by hired labor.

During the fiscal year all sheet piling has been driven, and grout under the battery and concrete between sheet piling and foundation piling, pavement in rear of battery, and riprap protection have been completed.

This battery is complete except sand protection and the mounting of guns.

Money statement.

Amount allotted from act of March 1, 1901		$30,000.00
July 1, 1901, balance unexpended		30,000.00
June 30, 1902, amount expended during fiscal year		16,877.61
July 1, 1902, balance unexpended		13,122.39
July 1, 1902, outstanding liabilities	$1,060.31	
July 1, 1902, covered by uncompleted contracts	3,216.25	
		4,276.56
July 1, 1902, balance available		8,845.83

Restoring railway approaches and fence around reservation.—This work has been done by hired labor.

During the fiscal year 4,808 linear feet of railway track was restored, 550 linear feet of railway track repaired, and 692 linear feet of railway trestle rebuilt.

The restoring of the fence around the reservation will be delayed until opportunity offers to secure enough fence posts from the sawed-off ends at the cedar piling of the railway trestle at Site No. 1.

Money statement.

Amount allotted from act of March 1, 1901	$6,000.00
July 1, 1901, balance unexpended	6,000.00
June 30, 1902, amount expended during fiscal year	4,432.41
July 1, 1902, balance unexpended	1,567.59
July 1, 1902, outstanding liabilities	110.30
July 1, 1902, balance available	1,457.29

SITE NO. 3.

At the beginning of the present fiscal year plans and estimates had been submitted for approval and engineer work had been preserved from the action of the teredo.

Plans and estimates were received approved July 7, 1901.

Work at this locality has been delayed in the hope that the Gulf and Interstate Railway, at Bolivar Point, would rebuild and operate its road. The possibility of their rebuilding now looks doubtful for any time in the near future, and plans are now being prepared for organizing the work at site No. 3 and rushing it through as quickly as possible. Everything but riprap and broken stone can probably be taken to the works by water. Riprap, etc., will probably be brought by barge from Buffalo Bayou to the old railway wharf at Bolivar Point and there placed on cars and delivered to the reservation. The United States will have to repair the track through the old Gulf and Interstate Railway yards sufficiently to carry this traffic, and will also have to repair the old railway wharf at Bolivar Point far enough out for barges to lie alongside of it.

Repair of battery for two 8-inch guns on disappearing carriages.—This battery is to be repaired by hired labor.

No construction work on this battery has been done. Approximately 15,000 cubic yards of sand have been placed under this battery for protecting the piling from the action of the teredo.

During the year sand washed from under the battery by high tides and storms has been replaced from time to time.

Money statement.

Amount allotted from act of March 1, 1901		$85,000.00
Amount expended on present project to end of last fiscal year		868.24
July 1, 1901, balance unexpended		84,131.76
June 30, 1902, amount expended during fiscal year		1,775.46
July 1, 1902, balance unexpended		82,356.30
July 1, 1902, covered by uncompleted contracts		28,801.08
July 1, 1902, balance available		53,555.22

Repair of battery for three 3-inch rapid-fire guns.—This battery is to be repaired by hired labor.

No construction work on this battery has been done. Approximately 3,000 cubic yards of sand have been placed under and around this battery for protecting the piling from the action of the teredo.

During the fiscal year sand washed from under the battery by high tides and storms has been replaced from time to time.

Money statement.

Amount allotted from act of March 1, 1901		$35,000.00
Amount expended on present project to end of last fiscal year		868.23
July 1, 1901, balance unexpended		34,131.77
June 30, 1902, amount expended during fiscal year		1,648.09
July 1, 1902, balance unexpended		32,483.68
July 1, 1902, outstanding liabilities	$64.75	
July 1, 1902, covered by uncompleted contracts	11,773.08	
		11,837.83
July 1, 1902, balance available		20,645.85

Restoring railway approaches and fence around reservation.—The restoring of railway approaches and fence around the reservation is to be done by hired labor.

No work has yet been done. Switches, frogs, etc., have been purchased and stored at Ninth street and Avenue A, Galveston, Tex.; also 41,240 feet B. M. of ties and caps, and 1,950 linear feet of piling.

Money statement.

Amount allotted from act of March 1, 1901	$3,000.00
July 1, 1901, balance unexpended	3,000.00
June 30, 1902, amount expended during fiscal year	698.86
July 1, 1902, balance unexpended	2,301.14
July 1, 1902, outstanding liabilities	1,441.05
July 1, 1902, balance available	860.09

The following balances from the appropriation for "Gun and Mortar Batteries," available and on hand at the close of the fiscal year 1901, were deposited to the credit of the appropriation:

Mortar battery at site No. 2, act of March 7, 1898	$6,649.47
Two emplacements for 3-inch rapid-fire guns at site No. 2, act of July 7, 1898	383.31
Three emplacements for 3-inch rapid-fire guns at site No. 3, act of July 7, 1898	165.43
Total deposited	7,198.21

Contracts in force during the fiscal year for materials, etc., for reconstruction and repair of fortifications, Galveston, Tex.

Formal contract.

Contractor: Isaac Heffron, Galveston, Tex.
Character of work: Furnishing large and small riprap and broken stone.
Rates:
At site No. 1.—Large and small riprap, $1.77 per ton; broken stone, $2.28 per cubic yard.
At site No. 2.—Large and small riprap, $1.97 per ton; broken stone, $2.47 per cubic yard.
At site No. 3.—Large and small riprap, $1.87 per ton; broken stone, $2.20 per cubic yard.
Date of approval: December 11, 1901.
Date of beginning work: March 7, 1902.
Date of expiration: September 1, 1903.

Emergency contracts.

Contractor: Ira C. Hutchinson, New York, N. Y.
Character of work: Furnishing natural cement.
Rate: $1.175 per barrel.
Date of approval: None; emergency contract.
Date of beginning work: March 1, 1902.
Date of expiration: No time set; contract in force until all cement covered by same has been ordered and accepted.

Contractor: The Texas Portland Cement and Lime Company, Galveston, Tex.
Character of work: Furnishing Portland cement.
Rate: $1.94 per barrel.
Date of approval: None; emergency contract.
Date of beginning work: June 30, 1902.
Date of expiration: No time set; contract in force until all cement covered by same has been ordered and accepted.

2 T.

DEFENSES OF LAKE PORTS.

Officers in charge of defenses of the Detroit River, Maj. Walter L. Fisk, Corps of Engineers, until November 7, 1901, and Capt. Lansing H. Beach, Corps of Engineers, since that date; Division Engineers, Col. Samuel M. Mansfield, Corps of Engineers, until July 24, 1901, and Lieut. Col. Oswald H. Ernst, Corps of Engineers, since that date. Officer in charge of defenses of Lake Champlain, Capt. Harry Taylor, Corps of Engineers; assistant, Lieut. Robert R. Raymond, Corps of Engineers, until November 2, 1901; Division Engineer, Col. Charles R. Suter, Corps of Engineers; officer in charge of other lake ports in New York, Maj. Thomas W. Symons, Corps of Engineers; Division Engineers, Col. Charles R. Suter, Corps of Engineers, until July 24, 1901, and Col. Samuel M. Mansfield, Corps of Engineers, since that date.

Fort Wayne, Mich.—Nothing was done to this fortification during the year, nor were any expenditures made on account of it.

The timber revetment on three sides of the rampart is now 40 years old or more, is in a very bad state of decay, and altogether a most unsightly and unserviceable affair; for this reason it might be well to remove it, so as to leave the whole rampart with interior earthen slopes, the condition in which the fourth side was placed several years ago. It would probably cost about $900 to make this change.

Fort Niagara, N. Y.—No operations have been carried on during the fiscal year.

Money statement.

July 1, 1901, balance unexpended	$150.70
June 30, 1902, amount expended during fiscal year	27.74
July 1, 1902, balance unexpended and available	122.96

Fort Ontario, N. Y.—No work of construction has been done since 1871.

An allotment of $450 was made May 20, 1901, and with these funds three revetments inside the fort were placed in thorough repair.

No other operations were carried on during the year.

Money statement.

July 1, 1901, balance unexpended	$450.00
June 30, 1902, amount expended during fiscal year	450.00

Fort Montgomery, N. Y.—Under allotments for preservation and repair for this work a fort keeper was employed to care for the public property stored at the fort and repairs were made to the fences of the reservation and to the bridge leading across the moat.

Money statement.

July 1, 1901, balance unexpended	$736.07
Allotted since	597.67
	1,333.74
June 30, 1902, amount expended during fiscal year	1,120.32
July 1, 1902, balance unexpended	213.42
July 1, 1902, outstanding liabilities	45.00
July 1, 1902, balance available	168.42

2 U.

DEFENSES OF SAN DIEGO, CALIFORNIA.

Officers in charge, Capt. James J. Meyler, Corps of Engineers, until December 12, 1901; Lieut. Col. Charles E. L. B. Davis, Corps of Engineers, from December 13, 1901, to January 28, 1902; Lieut. Col. Thomas H. Handbury, Corps of Engineers, from January 28, 1902, until March 31, 1902, and Capt. Edgar Jadwin, Corps of Engineers, since March 31, 1902; Division Engineers, Col. Jared A. Smith, Corps of Engineers, until September 23, 1901, and Lieut. Col. David P. Heap, Corps of Engineers, since September 23, 1901.

Ten-inch battery.—Two galleries were cut through the traverses at the reference of the loading platforms, one between emplacements Nos. 1 and 2 and one between Nos. 2 and 3, at a total cost, including superintendence, office expenses, etc., of $1,400. Plan and estimate were submitted for the substitution of chain ammunition hoists for the platform type now in use in the battery.

Three-inch rapid-fire battery on west side of bay.—No further work was done on this battery during the year. Its completion is delayed pending the arrival of the well linings, that they may be solidly embedded in the concrete.

Five-inch rapid-fire battery.—No work, except preservation, was done during the year.

Battery commander's station.—The type A, Lewis depression position finder was adjusted, its errors accurately determined, and a table of range-scale corrections prepared.

Datum points for range finders.—The three marks, which were completed during the previous fiscal year, were transferred to the artillery on July 22, 1901.

Sites for fortifications and seacoast defenses.—An allotment of $20,500 was made January 30, 1901, for the purchase of additional land. Negotiations for the purchase of this land from the owners had been completed and the deeds to same had been placed in escrow in the Bank of Commerce in San Diego before the end of the last fiscal year. The transfer of this property was completed September 12, 1901.

Three inch rapid-fire battery on east side of bay.—Work on this battery was begun in September, 1901; completed at a total cost of $10,000, and turned over to the artillery on May 10, 1902. The battery is interesting in that it is, so far as known, the first structure of the kind made with California Portland cement.

Supplies for seacoast defenses.—An allotment of $300 was made June 7, 1900, for the purchase of material to be supplied under the provisions of General Orders, No. 66, Adjutant-General's Office, 1900, for the service of the Coast Artillery, upon requisition of the post commanders, duly approved by the Chief of Engineers. All requisitions approved during the year were filled, at a cost of $20.19.

Preservation and repair of fortifications.—During the year the watchman was constantly employed in caring for the engineer property, painting, whitewashing, filling cracks, constructing a fence, and assisting in various ways in construction work and in the surveys made during the year.

Other work.—During the year plans and estimates were submitted

to the Department for installing an electric light and power plant and telautograph system and a searchlight system for the entrance to the harbor.

An estimate was also submitted for setting up a 30-inch searchlight outfit now on hand.

The work of laying and testing additional cables in the conduit of the mining casemate, in accordance with recommendation of the Torpedo Board dated March 17, 1902, was performed during the year. This work was done by artillery troops, no expense being incurred thereby.

During the year a proposed plan for the general construction of the post was received from the Quartermaster's Department, with request for approval. The plan, which involved the location of a central power plant and a possible change in position of the torpedo storehouse and cable tank, was forwarded with remark that, "subject to the approval of the Chief of Engineers, no objection is offered to this plan on the grounds of defense, provided provision is made for moving or replacing the temporary Engineer Department buildings when the necessity arises."

The fortification work at San Diego was in local charge of Assistant Engineer D. E. Hughes. Attention is invited to the appended extracts from Mr. Hughes's report containing data on various engineering features connected with the work. (See Appendix Z Z 8.) During the year Mr. Hughes, independently, developed and submitted a design for a chain hoist very similar in principle to the Raymond-Taylor hoist, for which he was commended by the Chief of Engineers.

Money statements.

GUN AND MORTAR BATTERIES.

Emplacements for two 3-inch rapid-fire guns, west side of bay.

July 1, 1901, balance unexpended	$598.25
June 30, 1902, amount expended during fiscal year	99.85
July 1, 1902, balance unexpended and available	498.40

Emplacements for two 3-inch rapid-fire guns, east side of bay.

July 1, 1901, balance unexpended	$9,998.95
June 30, 1902, amount expended during fiscal year	9,998.95

Cutting passages at 10-inch battery.

November 22, 1901, amount allotted	$1,200.00
February 14, 1902, amount allotted	200.00
	1,400.00
June 30, 1902, amount expended during fiscal year	1,400.00

SUPPLIES FOR SEACOAST DEFENSES.

July 1, 1901, balance unexpended	$300.00
June 30, 1902, amount expended during fiscal year	20.19
July 1, 1902, balance unexpended and available	279.81

SITES FOR FORTIFICATIONS AND SEACOAST DEFENSES.

July 1, 1901, balance unexpended	$20,500.00
June 30, 1902, amount expended during fiscal year	20,500.00

PRESERVATION AND REPAIR OF FORTIFICATIONS.

July 1, 1901, balance unexpended	$816.30
August 20, 1901, amount allotted	299.03
	1,115.33
June 30, 1902, amount expended during fiscal year	1,089.54
July 1, 1902, amount unexpended	25.79
July 1, 1902, outstanding liabilities	8.58
July 1, 1902, balance available	17.21

2 V.

DEFENSES OF SAN FRANCISCO, CALIFORNIA.

Officers in charge, Lieut. Col. Charles E. L. B. Davis, Corps of Engineers, until January 28, 1902, and Lieut. Col. Thomas H. Handbury, Corps of Engineers, since that date. Officer in charge of torpedo defenses, Lieut. Col. William H. Heuer, Corps of Engineers.

BATTERIES ON NORTH SIDE OF HARBOR.

At the close of the last fiscal year the condition of the work was as follows:

Emplacements for two 12-inch rifles on disappearing carriages.—The excavation for the battery was begun and the excavation for opening the quarry was about completed; a rock crusher was delivered on the site of works; and the machinery for the general plant, taken from various places about the harbor where work had been conducted, was being installed for service.

Battery for eight 12-inch B. L. mortars.—Actual construction of the battery had not been begun, but the plant for concreting for this battery and the 12-inch battery was being prepared. The shipment of several of the mortar carriages from the East was under way. Two of the carriages had been received in San Francisco.

Wharf and tramway.—This work was completed. The cars, cable, engine, etc., had been provided, and the plant was in operation.

Engineer buildings.—Plans for the buildings had been prepared and the lumber was delivered. One bunk house was practically completed and the construction of the mess house commenced.

General electric-light plant.—Funds were available, but no work had been done.

Two emplacements for 12-inch rifles on disappearing carriages.—The emplacements were completed, the guns mounted, and the battery in charge of the artillery.

Two emplacements for 5-inch rapid-fire guns on balanced-pillar mounts.—The emplacements were completed and the artillery were preparing to mount the carriages.

Emplacements for three 12-inch rifles on nondisappearing carriages.—The emplacements were completed, the guns mounted, and the battery was in charge of the artillery.

Two emplacements for 8-inch rifles on nondisappearing carriages.—The emplacements were completed, the guns mounted, and the battery was in charge of the artillery.

Searchlight.—The searchlight was installed, test runs made, and work completed, and searchlight in charge of artillery.

During the year the work done was as follows:

Emplacements for two 12-inch rifles on disappearing carriages.—At the close of the last fiscal year the battery excavation had been begun and about 500 cubic yards of material had been removed. The main excavation was completed in September. The material was sandy soil mixed with clay. The material encountered at the floor level was of no better bearing value, and, since it was apparent that a sufficient covering of concrete could not be gotten over the battery area before the fall rains began, it was decided to make the footing under the floors 3 feet 6 inches deep, instead of 1 foot, as originally planned. This added about 1,000 yards to the mass of masonry, but the wisdom of taking the step proved itself before the winter was far advanced. The foundation, as soon as saturated with water, became very spongy; by having the heavy undermass, however, concreting was proceeded with without interruption, and no settling whatever occurred.

The gun carriages with base rings were received in San Francisco during April; the Quartermaster's Department contracted to transport them to the beach in the cove, and the Engineer Department entered into contract with George Davis & Son, on June 16, 1902, to take them from the beach to the battery site.

The work of construction during the year included the placing of all the battery concrete with the exception of finishing the parapet and flanking walls and the loading platform of gun No. 2. The former is about 50 per cent done, the flanking wall not begun, and the platform about 80 per cent done. In addition there remains the latrine building and two sets of concrete steps. About 9,010 yards of concrete were placed in the battery, at a cost of $4.37+ per cubic yard, which figure embraces all items of cost properly attributed to concreting, excepting that of plant. Nineteen thousand five hundred and ninety cubic yards of concrete are to be placed in the several batteries now authorized and upon which work is proceeding. The cost of the general plant, for the equipment of wharf and tramway, opening quarry and quarry machinery, the Lidgerwood cableway, and the concrete mixer, has been $22,752.40, or $1.11+ per cubic yard of concrete to be placed. The excavation for the superior slope of the battery was carried 90 per cent toward completion, about one-half of the steel doors were hung, the cement finishing is about 70 per cent done, and chain ammunition hoist for gun No. 1 partially erected.

Battery for eight 12-inch B. L. mortars.—The excavation for this battery was in fine sand, fairly well compacted. It was easily removed with scrapers. Hard compact clay was encountered on the right flank of the battery under the service rooms, while on the left flank, under the end-pit wall, rock was found. The ledge extended under the two gun platforms nearest the wall, but dipped below the next two and the remainder of the battery.

Roads.—A permanent road was built connecting the two 12-inch

gun battery with the mortar battery. For a distance of 1,500 feet it leads through deep sand. A brush foundation was first laid, consisting of the stalks of lupin and sage brush, which were lightly covered with sand and left for the winter rains to pack firmly. Upon this footing were spread layers of disintegrated rock from the excavation for the two 3-inch battery, and also crushed stone with considerable fine material from the quarry. The road was then watered and rolled with a roller of the "corrugated" type of 3 feet width and weighing 4,500 pounds. The roller was built on the works, the castings being obtained from a city foundry, having been made to order from drawings. Its cost, complete, was about $196.

Transportation of ordnance.—The transportation of mortar carriages from the city to the battery was completed in June, 1902. The contractor for the Quartermaster's Department in transporting them to the beach in the cove lost one load of ordnance during a severe storm in April, which sent the barge adrift in the cove and wrecked it on a rocky point below the life-saving station. All the parts which went overboard have been recovered, with the exception of three small end springs, one ladder brace, and one hand wheel of carriage No. 284. Additional parts of that carriage and parts of Nos. 282 and 283 were damaged in the way of breaking projecting portions of castings and by rusting.

Wharf and tramway.—No work was done during the year and the plant is in good working order.

Engineer buildings.—The buildings for quartering the engineer workmen and for general purposes in constructing the battery were completed in August, 1901. They consist of two bunk houses, holding about 150 men; a mess and cook house capable of cooking for 150 men and seating 130 men at tables at one time; a stable for 22 horses, with a storage room for about 18 tons of forage; a cement shed with capacity for about 5,000 barrels; a combined carpenter and blacksmith shop; and an office building with additional rooms for quartering engineering assistants. The buildings were whitewashed in April of this year. The following is a statement of the cost of each building erected complete, which includes the cost of the transportation of the lumber from the city to the works:

1 cook and mess house		$1,442.38
2 bunk houses		1,568.67
Office		816.18
Stable		771.85
Cement shed		751.90
Carpenter and blacksmith shop		618.65
Miscellaneous:		
Superintendence	$150.00	
Blacksmithing	115.89	
Water supply	83.95	
Painting and whitewashing	74.70	
Teaming	51.88	
Drainage	72.18	
Holidays	51.00	
Latrines	59.60	
		659.20
Total		6,628.83

General electric plant.—No work was done during the year in providing a general electric plant. The late report of the board of officers on the subject requires the matter of searchlight and garrison

service to be provided for, as well as for the emplacement lighting, hence as soon as more definite information can be obtained on the first two subjects, consideration of the general electric plant will be taken up. Funds are available for this work.

Two emplacements for 3-inch rapid-fire guns.—Work on this battery was authorized on August 10, 1901. The active construction work consists principally of the excavation which has been carried along about 60 per cent toward completion. Very little excavation is necessary to begin concreting and this excavation will be taken up as soon as the concrete work of the mortar battery is farther advanced.

Four emplacements for 6-inch rapid-fire guns.—Work on this battery was authorized on August 17, 1901. A road connecting the two rapid-fire batteries with the main road leading to the two 12-inch battery was built and ballasted with the disintegrated rock taken from the two 3-inch gun battery excavation. The active work of construction consisted principally of the excavation, which was well opened and advanced 25 per cent toward completion. The material encountered was first a 2-foot layer of loose sand, then a hard, compact clay, tending to rock. It is believed that a ledge will soon be encountered. It is the purpose to do the concrete work for the rapid-fire batteries from the main mixer plant at the two 12-inch gun battery; hence the active construction has not been pushed until the larger batteries are done.

Battery for two 5-inch guns.—The work done in this battery during the year is accounted for under the head of "Preservation and Repair of Fortifications." During the year the artillery mounted the carriages. The guns had not arrived.

Preservation and repair of fortifications.—Battery for three 12-inch guns on nondisappearing carriages. The concrete roof, put on in 1900, was painted with two coats of brown metallic paint. Some work was done in the magazine galleries, rounding off sharp angles, widening passages, etc., to facilitate the passage of ammunition trucks. The work was stopped, however, upon the receipt of instructions from the Department to prepare plans and estimates for changing the ammunition hoists from platform lifts to modern chain hoists; said plans have been prepared and submitted. A coat of whitewash was given to the rooms and passages of emplacement No. 3. The battery being unprovided with a room for the storage of gun rammers, wipers, sponges, etc., it was determined, upon the request of the artillery, to build a small wooden shelter on the loading platform of gun No. 2, placing the same longitudinally against the traverse between guns Nos. 2 and 3. The dimensions of the structure are 5 feet by 6 feet by 24 feet long, with hip-roof, shingled, and sides of plain 1 inch by 12-inch planking. It has an end door and a long side opening facing the gun.

The following is a statement of the cost of the work done at the battery during the year:

Cutting concrete, interior passages, and replastering same	$215.00
Painting roof and whitewashing interior rooms, emplacement No. 3	80.36
Wood shelter for gun rammers and wipers	27.29
	322.65

Two emplacements for 5-inch rapid-fire guns: The water piping of the latrine was repaired and the superior earth slope was sown with alfalfa.

Battery of two 8-inch guns on nondisappearing carriages: A steel grate was installed in the fireplace of the guardroom.

Miscellaneous repairs: The fort keeper was engaged in miscellaneous repairs about batteries and in caring for engineer buildings and property.

For a number of years past the tide has been washing down the road connecting the artillery post with the engineer camp. It was determined, in order to prevent farther encroachment, to erect a dry rubble wall along said road. The section of wall was made 2 feet top width, 4 feet bottom width, face batter 1:6, and averaging about 5 feet in height. Two hundred and forty linear feet of this wall was built to the northward and about 150 linear feet, of less height, to the southward of the cement storehouse. The wall upon which this latter structure stands was damaged somewhat during the winter by storms and was repaired. This rubble retaining wall was built at a cost of $497.

Money statements.

GUN AND MORTAR BATTERIES.

Emplacements for two 5-inch rapid-fire guns.

July 1, 1901, balance unexpended		$199.77
June 30, 1902, amount expended during fiscal year		199.77

Emplacements for two 12-inch rifles on disappearing carriages.

July 1, 1901, balance unexpended		$115,603.77
September 16, 1901, amount allotted		9,490.00
		125,093.77
June 30, 1902, amount expended during fiscal year		95,206.11
July 1, 1902, balance unexpended		29,887.66
July 1, 1902, outstanding liabilities	$5,044.51	
July 1, 1902, amount covered by uncompleted contracts	2,500.00	
		7,544.51
July 1, 1902, balance available		22,343.15

Mortar battery for eight 12-inch mortars.

July 1, 1901, balance unexpended		$103,625.02
June 30, 1902, amount expended during fiscal year		46,187.36
June 30, 1902, balance unexpended		57,437.66
July 1, 1902, outstanding liabilities	$4,168.49	
July 1, 1902, amount covered by uncompleted contracts	1,856.25	
		6,024.74
July 1, 1902, balance available		51,412.92

Wharf and tramway.

July 1, 1901, balance unexpended		$1,155.45
October 1, 1901, amount transferred to other work	$181.95	
June 30, 1902, amount expended during fiscal year	973.50	
		1,155.45

Engineer buildings.

July 1, 1901, balance unexpended		$6,019.00
October 1, 1901, amount transferred from other work		181.95
		6,200.95
June 30, 1902, amount expended during fiscal year		6,200.95

Electric plant.

July 1, 1901, balance unexpended	$23,595.00
July 1, 1902, balance unexpended and available	23,595.00

Two 3-inch gun emplacements.

August 10, 1901, amount allotted	$16,787.70
June 30, 1902, amount expended during fiscal year	1,780.29
July 1, 1902, balance unexpended	15,007.41
July 1, 1902, outstanding liabilities	184.50
July 1, 1902, balance available	14,822.91

Four 6-inch rapid-fire gun emplacements.

August 17, 1901, amount allotted	$54,409.00
June 30, 1902, amount expended during fiscal year	738.14
July 1, 1902, balance unexpended	53,670.86
July 1, 1902, outstanding liabilities	932.35
July 1, 1902, balance available	52,738.51

PRESERVATION AND REPAIR OF FORTIFICATIONS.

July 1, 1901, balance unexpended	$2,839.20
June 30, 1902, amount expended during fiscal year	2,721.06
July 1, 1902, balance unexpended and available	118.14

BATTERIES ON ISLANDS IN HARBOR.

At the close of the last fiscal year the condition of the work was as follows:

Emplacement for one 8-inch rifle on disappearing carriage.—The emplacement was completed, the gun mounted, and the battery was in charge of the artillery.

Emplacements for two 5-inch rapid-fire guns on pedestal mounts.—The emplacements were completed excepting the setting of the pedestals, which had not arrived. The battery was in charge of the artillery.

Emplacement for one 8-inch rifle on nondisappearing carriage.—The emplacement was completed, the gun mounted, and the battery in charge of the artillery.

Preservation and repair of fortifications.—Battery for one 8-inch gun: The engine of the electric plant at this battery was repaired, at a cost of $25.

The watchman was employed during the year in general care of all engineer buildings and property.

Money statements.

GUN AND MORTAR BATTERIES.

Emplacements for two 5-inch rapid-fire wire-wound guns.

July 1, 1901, balance unexpended	$48.42
July 1, 1902, balance unexpended and available	48.42

PRESERVATION AND REPAIR OF FORTIFICATIONS.

July 1, 1901, balance unexpended	$1,302.00
June 30, 1902, amount expended during fiscal year	762.61
July 1, 1902, balance unexpended and available	539.39

BATTERIES ON SOUTH SIDE OF BAY.

At the close of the last fiscal year the condition of the work was as follows:

Emplacement for 8-inch rifle on disappearing carriage.—The emplacement was entirely completed, the gun was mounted, and the battery in charge of the artillery.

Emplacements for three 8-inch rifles on disappearing carriages.—The battery was completed, the guns mounted, and the battery was in charge of the artillery.

Emplacements for two 5-inch rapid-fire wire-wound guns.—The battery was completed excepting the setting of the base rings, which had not been received, and was in charge of the artillery.

Emplacements for two 3-inch rapid-fire guns.—The battery was completed excepting the installation of minor fixtures, whitewashing and painting, and setting the cylinders.

Emplacements 6, 7, and 8, for 12-inch rifles on disappearing carriages.—The engineering work was completed, the guns mounted, and the battery turned over to the artillery.

Emplacements 9, 10, 11, 12, and 13, for 10-inch rifles on disappearing carriages.—The engineering work was completed, the guns mounted, and the battery turned over to the artillery.

Emplacements 14, 15, 16, 18, and 19, for 12-inch rifles on nondisappearing carriages.—The engineering work was completed, the guns mounted, and the battery turned over to the artillery.

Emplacements B, C, and D, for 5-inch rapid-fire guns on pillar mounts.—The work was completed except putting in a surface drain on the exterior slopes, installing two iron ladders, and some minor fixtures. The carriages were mounted.

Pneumatic dynamite-gun battery.—The battery was completed and in charge of the artillery and the guns were mounted.

Mortar battery No. 1.—The battery was in charge of the artillery and 16 mortars were mounted. The old azimuth circles had been removed and arrangements for putting in new ones for carriage of 1896 model were being made. An allotment of $5,233 for this work and for constructing a latrine at this battery was available.

Mortar battery No. 2.—The battery was completed and in charge of the artillery; 16 mortars were mounted.

Emplacements for two 6-inch guns on disappearing carriages.—The battery was completed and in charge of the artillery. The carriages were mounted, but the guns had not been received.

Emplacements for two 12-inch guns on disappearing carriages.—The battery was completed excepting the setting of base rings, which had not been received.

Emplacement for one 12-inch gun on nondisappearing carriage.—An allotment of $60,000 was available, but work had not been commenced.

Emplacements for sixteen 12-inch mortars.—The work was completed excepting the installation of minor fixtures and the setting of 12 base rings.

Searchlight.—The work was completed.

Land for fortifications.—The land was purchased and paid for, but some slight discrepancy in the metes and bounds remained to be remedied.

During the year the work done was as follows:

Emplacements for two 3-inch rapid-fire guns.—The same method of construction was followed in this battery as in the three 3-inch gun emplacements hereafter mentioned, except that no damp-proof course was placed in the monolith containing the magazine. To date there has been no signs of leakage in this battery.

Emplacements for three 3-inch rapid-fire guns.—This work was commenced in July, 1901.

The excavation was in sand and clay, and was carried on by scrapers and in part by the use of carts.

Concrete was mixed entirely by hand and distributed with wheelbarrows. Proportions, counting 1 barrel of cement as 4.5 cubic feet: (1) In northeast corner of battery, to fill excess of excavation up to main-floor grade and along side of magazines, 1:6:12 (48 cubic yards); (2) breast walls and east wall of magazine No. 1, 1:3:8 (129 cubic yards); (3) balance, 1:3:6 (707 cubic yards). The cost of ingredients at the works was—cement, $2.52 per barrel; sand, 67½ cents per cubic yard; rock, $2.14½ per cubic yard; mixing and placing, 84 cents per cubic yard.

The average cost of the concrete placed, including cement used for concrete, for grouting, etc., and excluding cost of plant and forms, was $4.67½ per cubic yard; including these two latter items the cost was $5.87 per yard.

Electric lights.—Provision was made to wire this battery with open-cleat wiring, but no wiring nor lamps were put in place, as there is not sufficient electric power in the vicinity to supply the battery.

Minor accessories, etc.—The usual water-supply pipes, speaking tubes without mouthpieces, doors, windows, etc., were supplied. The interior of all rooms was whitewashed.

Refill, slopes, etc.—The refill was made with material from excavation, and all slopes were covered with loam. It was found necessary to cut away the bank to a certain extent in front of the 8-inch battery in order to make a clean line of fire in that direction. The cut was made sufficient for the additional gun which is to be placed in emplacement No. 4 of this battery, yet to be constructed.

Roadway.—A macadamized road was made from McDowell avenue to the battery, and a fence with two gates constructed.

The cost of the work was as follows:

Roadway and fence:		
Road	$287.90	
Fence and gates	229.38	
		$517.28
Excavation:		
Clearing site	83.70	
Excavation, 2,800 cubic yards, at $0.326	912.69	
		996.39
Forms		979.88
Plant		74.50
Concrete, 884 cubic yards, at $4.67		4,133.54
Drainage and waterproofing:		
Drains and sewers	$188.13	
Damp-proof course	158.10	
Gutters, sumps, etc	112.88	
Paraffin painting	94.26	
Dry wall of rock against walls	64.78	
		618.15
Ventilation		20.29

I-beams		$58.54
Wooden steps and iron railings		292.62
Water system		43.65
Doors and windows		293.02
Speaking tubes		77.46
Cement finishing:		
Top finish	$158.10	
Floors and walks	254.39	
Plastering and pointing	383.21	
		795.70
Whitewashing		9.60
Painting		71.35
Electric lights, strips for wiring		15.42
Fireplace and grate		18.41
Blacksmith shop, general jobbing, etc		134.28
Carpenter shop, general jobbing, etc		36.76
Backfill, slopes, etc.:		
Grading line of fire	$216.25	
Backfill and slopes	812.02	
Repair of slopes	48.50	
		1,076.77
Watchman and policing		731.65
Holidays		68.00
Main office		904.05
Field office, office material, superintendence		1,716.51
General utility, teaming, forage, repair to harness, stables, etc		1,417.53
		15,101.35
Estimate to finish:		
Setting 3 gun mounts, at $30	$90.00	
Policing, etc	8.65	
		98.65

Emplacements B, C, and D for 5-inch rapid-fire guns on balanced-pillar mounts.—Surface drains were put in on exterior slopes, an iron ladder and minor fixtures were installed, and the battery completed. The battery was transferred to the artillery on October 1, 1901. Carriages were mounted; guns were not received.

Mortar battery No. 1.—Work was continued on the removal of the azimuth circles for carriages of model 1891. These circles were embedded in the concrete of the platform, which was carried up to the level of the top of the racer, and was about one-half inch away from it.

To adapt the platforms to the new azimuth circles an annular ring of concrete about 36 inches deep and 22 inches wide was removed and pockets cut for the radial brackets supporting the floor plates. When the new azimuth circles were placed by the Ordnance Department the necessary cement finishing to complete the platforms was done.

The pockets for the brackets and surface chipping, made necessary to bring the new work fair with the old finish of the loading platform, was done by hand. The large mass of the annular ring was removed by a steam drill and by blasting. Around each platform a concentric circle of holes about 6 inches apart was drilled down to grade, and from this circle toward the center of the platform other holes were similarly drilled at irregular intervals. This weakened the mass sufficiently for small charges of powder to remove it without weakening the rest of the platform. An "A 35 Sergeant steam rock drill" was used, having a feed of about 12 inches. This would drill about 76 feet of 1-inch holes per day of eight hours, including changes.

The excavated concrete was used to repair roads in the vicinity of the battery.

The following is a detailed statement of the cost of the work:

Removing old azimuth circles from 16 platforms, at $4.06+		$65.00
Excavating concrete:		
By drill, 3,916 cubic feet, at $0.596, inclusive of plant	$2,335.08	
By hand, 152 cubic feet, at $1.13+	173.00	
		2,508.08
Setting new azimuth circles and cement finishing 16 platforms, at $40.98+		655.75
Drilling and cleaning out drains		23.50
Field office and superintendence		150.00
		3,402.33

Construction of a latrine: This building is of concrete and is divided into separate rooms for officers and enlisted men.

The fixtures (on the ground, but not yet installed) are all modern and of the best of their several kinds, those for the enlisted men being especially chosen to withstand the careless treatment to which they are likely to be subjected.

The sewer connects with the Quartermaster's-Department sewer from the new quarters, now being built, which runs to the bay. The plumbing throughout was designed in accordance with the most approved sanitary laws.

The following is a detailed statement of the cost of the work:

Excavation		$33.50
Forms		306.08
Concrete:		
Foundation	$101.40	
Building, 70 cubic yards, at $4.149	290.28	
		319.68
Cement finishing		66.00
Strips for electric wires		2.76
Doors, windows, and gratings		36.89
Water supply		7.50
Sewer, 1,000 feet, at $0.232+		232.30
Fixtures and plumbing (contract)		718.00
Policing		35.96
Total		1,830.67

Emplacements for two 12-inch rifles on disappearing carriages.—Some of the ironwork was painted to prevent rusting and a few changes were made in the electric wiring. Carriage No. 26 was received and its base ring set. The battery is completed except one base ring, which has not been received. No guns have been received for this battery.

One emplacement for 12-inch rifle on nondisappearing carriage.—Work was commenced in July, 1901.

Excavation: Owing to the sliding of upper strata of land on the site of this battery the excavation was made excessive to obtain a stable foundation. Part of the excavation was made with scrapers and part by blasting and with horses and carts.

Concrete: The concrete was mixed entirely by hand, distributed with wheelbarrows, and was of the following proportions, counting a barrel of cement as 4.5 cubic feet: (1) In the northwestern corner of the battery, to fill in excess of excavation up to main floor grade, 1:6:12 (22 cubic yards); (2) foundations, floors, gutters, and breast wall in front of gun platform, 1:3:8 (1,184 cubic yards); (3) all the remainder, 1:3:6 (3,140 cubic yards).

The cost of ingredients at the works was—cement, $2.42 per barrel; sand, $1.06 per cubic yard; rock, $2.11 per cubic yard; mixing and placing, exclusive of all plant expenses, 82 cents per cubic yard in place.

Proportions.	Number of yards.	Loose material per yard of concrete in place, in yards.				Cost of material per yard of concrete.	Mixing and placing.	Total.
		Cement.	Sand.	Rock.	Total.			
1:6:12	22	0.06	0.36	0.72	1.14	$2.77+	$0.82	$3.59+
1:3: 8	1184	.11 +	.35	.935	1.395	3.94+	.82	4.76+
1:3: 6	3140	.144−	.43+	.86+	1.434	4.36+	.82	5.18+

Considering the total amount of concrete placed, irrespective of proportions, and including cement for grouting, the average cost was $5.12+ per cubic yard; inclusive of plant, the cost per cubic yard was $5.26+; inclusive of both plant and forms, the cost per cubic yard was $5.97+.

The battery was built in six separate monoliths, i.e., (1) gun platform, (2) breast wall in front of gun platform, (3) terreplein or loading platform, (4) south portion up to the loading platform, (5) north portion up to the loading platform, and (6) apron in front of breast wall.

One of the contiguous faces of each monolith was plastered and painted with heavy crude oil to insure against adhesion, and a lead flashing was run the entire length of the joint, near the surface, to prevent leakage.

Forms: The work as described above considerably increased the cost of the forms.

Drainage: As soon as the concrete was brought up to grade the top finish was immediately put on to insure a perfect bond, and the slope of the top was considerably increased over that of the typical drawings to facilitate drainage. A damp-proof course was carried in the concrete above the height of the rooms, draining into a gutter, and connected to the sewer system. The extremities of this course of tiling were vented to give a good circulation of air.

Every precaution was taken to guard against leakage. Ample drainage was placed throughout the battery and around the foot of all walls next to the earth fill. These walls were plastered and painted with paraffin and a course of rock was carried up between the walls and the earth to insure the rapid drainage of any water from the face of the walls. Also the rear slopes of the battery were drained to catch all surface water flowing toward the emplacement.

Ventilation: All rooms and passages were vented and also each lamp closet. These lamp closets are sometimes used during drill when the electric-light plant is not running, and might be used if the plant broke down. The vents make the lamps burn better and prevent them from smoking.

Ammunition service: Recesses were built in the walls for armament chests, sponges, rammers, and shot trucks. A trolley system to handle the shot and an endless-chain hoist with electric motor to convey the ammunition to the loading platform were installed. As an auxiliary to the hoists two cranes were placed at the rear of the loading platform.

Electric-light plant: A 7-kilowatt direct-connected steam generat-

ing set was installed to light this emplacement and also emplacements 1 and 2, the oil engine at emplacements 1 and 2 being used to run the electric motors for the chain hoists in these emplacements. The wiring for lights is all in concealed iron-armored conduit, each room being on a separate circuit, and the feeders to emplacements 1 and 2 are lead-covered cable run in sewer-pipe conduit.

Minor accessories, etc.: The usual water-supply pipes, speaking tubes, doors, windows, etc., were installed. Mouthpieces were left off, the speaking tubes awaiting the perfection of an improved mouthpiece. The interior of all rooms was whitewashed.

Refill, slopes, etc.: The refill was made of material from the excavation. As the excavation was in excess of the fill, the earth protection is considerably greater than shown on typical drawings. The superior and rear slopes were covered with loam. This was expensive, but necessary, as otherwise the sand would blow about the battery, to the serious damage of finished and wearing surfaces of ordnance, etc. At a greater distance from the battery the sand was controlled by planting bunch grass and lupine.

Roadway: A macadamized road was built to this battery from the Forty-third avenue entrance to the reservation. The banks on either side of this road were also protected by planting bunch grass.

The following is a detailed statement of the cost of this battery:

Road from Forty-third avenue, 15 feet wide, 1,200 feet long, at $1.763 per linear foot	$2,115.84	
Gate and temporary fence	57.58	
		$2,173.42
Excavation:		
4,000 cubic yards, at $0.55	$2,200.00	
7,000 cubic yards, at $0.26	1,827.70	
		4,027.70
Forms		3,052.96
Plant		641.40
Concrete, 4,346 cubic yards, at $5.12+ per cubic yard		22,267.36
Drainage and waterproofing:		
Drains and sewers	$432.79	
Partition tile	345.91	
Gutters	154.35	
Lead flashings	45.90	
Paraffin painting	368.47	
Dry wall of rock against walls	669.47	
		2,016.89
Ventilation		107.10
I-beams		1,273.94
Ring bolts, anchor bolts, and iron railings		167.80
Ammunition service:		
Trolleys	$413.62	
Chain hoist	1,164.50	
Motor for hoist	180.36	
Cranes	145.50	
Rammer and sponge racks	36.99	
		1,940.97
Water system and water		165.11
Doors and windows		1,511.64
Speaking tubes		337.03
Cement finishing, etc.:		
Top finish	$614.55	
Floors	654.56	
Plastering and pointing	843.79	
Whitewashing	55.53	
		2,168.43
Painting		153.38

Electric-light plant:		
Generating plant installed (contract)	$2,190.00	
Conduit, lighting material, and wiring	1,137.20	
Engine bed, workbench, etc	108.09	
		$3,435.29
Carpenter shop, general jobbing, tools, etc		362.08
Blacksmith shop, general jobbing, tools, etc		1,554.83
Wooden steps		91.03
Back fill		662.91
Loaming and seeding slopes		2,083.70
Repair of buildings, watchman, policing, holidays		1,831.05
Main office		2,185.50
Field office, instruments, telephone, general teaming, superintendence, etc.		5,064.05
		59,275.57

Estimate to finish:	
Whitewashing boiler room	5.00
Finishing floor in boiler room	15.00
Building coal bunker in boiler room	25.00
Testing electric-light plant	25.00
Locks for doors (ordered but not yet delivered), 16, at $1.25	20.00
Setting base ring and finishing platform	100.00
	190.00

The battery is entirely completed except setting base ring of carriage, which was not received. The gun for this battery was not received.

Emplacements for sixteen 12-inch B. L. mortars.—Grates for fireplaces were installed, eleven base rings were set, and the firing wires completed as far as practicable until the remaining base ring and its carriage are received. One mortar was received and mounted by the artillery.

Searchlight.—The installation of searchlight being completed, the outfit was turned over to the artillery. Some repairs and changes were made, which are accounted for under the heading "Preservation and Repair of Fortifications."

Land for fortifications.—A slight discrepancy in the metes and bounds of the tract of land purchased was corrected by order of the United States district court, and the necessary record made in the office of the county recorder of San Francisco County.

Range-finder station (Type B) for 12-inch battery.—An observation station was built in this battery between emplacements 14 and 15 and just to the rear of the magazines. The excavation for this foundation was carried to the roof of the passageway leading to the rooms, to avoid settlement as the earth covering was placed by hand. A wooden bridge, with pipe railing and wooden steps, leads to the station from the road immediately in rear of the battery. A speaking tube was laid from the station to the relocating room of the battery.

The cost of the work was as follows:

Excavation	$43.00
Forms and plant	73.50
Concrete	112.45
Cement finishing	21.00
Backfill and repair of slopes	24.00
Wooden bridge, steps, and pipe railing	118.62
Speaking tube	56.82
Stationery, main office	.61
	450.00

Electrical connections, emplacements 6 and 7.—In accordance with orders from the Chief of Engineers, conduits for electric wires were laid at emplacements 6 and 7, running from rooms in the emplacements to the gun platforms. The wires supply motors, placed on the gun carriage, to maneuver the gun both in azimuth and vertical circle.

These two installations were made, one by the Sprague Electric Company and the other by the General Electric Company (not yet finished), for the purpose of comparative tests.

The only portion of the work with which the Engineer Department was concerned was the laying of the conduit.

Owing to the difficulty encountered in laying the conduit in emplacement 6 (the excavation consisting of tunneling through hard rock), the relative location of the controlling device was changed in emplacement 7, which materially cheapened the cost of the conduit.

As the wires leading into the rooms where the controlling devices were installed were for lamps only, it became necessary to run feeders of greater current-carrying capacity into these rooms.

The work required to be done by the Engineer Department was completed at the following cost:

Laying conduit	$308.76
Concreting, repair of floors, etc	5.00
Wiring	53.41
Policing	7.00
Office expenses and stationery	.83
	375.00

Preservation and repair of fortifications.—During the year the fort keeper, assisted by such labor as was necessary, was engaged in the care of Government property and in the repair and maintenance of buildings, sewers, drains, fences, and roads, and in general work around the batteries.

The bulkhead protecting the sea wall leading to the old brick fort was damaged during a severe storm, and was repaired at a cost of $137.20.

The following is a statement of work done on the modern batteries on the southern shore of San Francisco Harbor, the cost of which was paid from the appropriation "Preservation and Repair of Fortifications:"

Battery of one 8-inch gun: Repairs to oil engine of electric plant.

Battery of three 8-inch guns: Repairs to latrine.

Battery of three 12-inch guns: Repairs to triplex block, doors, and tool room. Repairs were made to the traverse (emplacement 7) in order to prevent dampness. These repairs consisted of the removal of the earth filling above the rooms, chipping off the cement finish of the old work, filling in again with concrete, giving the finish a very pronounced slope, and carrying a dry wall of rock between the earth fill and the walls.

Where vertical joints occurred between the old and new work, lead flashings were run, draining into the dry wall of rock.

No heavy rains have occurred since the completion of this work, but to date the magazines and rooms have been dry. It is thought that if similar treatment were given to other emplacements where leakage occurs it would prove to be satisfactory.

The cost of these repairs (emplacement 7) is as follows:

Excavation	$539.18
Chipping concrete	387.16
Plant	25.00
Forms	143.51
Concrete	1,799.14
Flashings, lead	313.30
Cement finishing	452.92
Paraffin painting	61.00
Drainage	164.24
Repair to chimneys	8.90
Backfilling	309.50
Whitewashing rooms	15.00
Policing	17.25
	4,236.10

Battery of five 10-inch guns: Repairs to triplex blocks.

Battery of three 12-inch guns: Repairs to reflectors for lamps, to slopes, and to elevator. New wooden steps and a speaking tube to battery commander's station were installed.

Battery of two 12-inch guns: Repairs to voltmeter of electric plant.

Mortar battery No. 1: Repairs to electric-light plant and whitewashing guard room.

Mortar battery No. 2: Repairing locks, whitewashing, and installing new grates for fireplace.

Searchlight: Whitewashing and painting and repairs to and changes in machinery.

Money statements.

GUN AND MORTAR BATTERIES.

Emplacements for two 5-inch rapid-fire wire-wound guns.

July 1, 1901, balance unexpended		$42.78
July 1, 1902, balance unexpended and available		42.78

Emplacements for two 8-inch rapid-fire guns.

July 1, 1901, balance unexpended		$4,374.74
Amounts received by value of cement transferred to other works:		
July 31, 1901	$575.00	
December 31, 1901	313.56	
January 31, 1902	273.78	
		1,162.34
		5,537.08
June 30, 1902, amount expended during fiscal year		5,036.72
July 1, 1902, balance unexpended and available		500.36

Emplacements for three 8-inch rapid-fire guns.

July 1, 1901, balance unexpended		$15,200.00
Amounts transferred to other works on account of cement received, as follows:		
July 31, 1901	$575.00	
December 31, 1901	156.78	
June 30, 1902, amount expended during fiscal year	14,369.57	
		15,101.35
July 1, 1902, balance unexpended and available		98.65

Two emplacements for 5-inch rapid-fire guns.

July 1, 1901, balance unexpended		$1,109.41
June 30, 1902, amount expended during fiscal year		1,109.41

One emplacement for 5-inch rapid-fire gun.

July 1, 1901, balance unexpended		$365.24
June 30, 1902, amount expended during fiscal year		365.24

Mortar battery No. 1.

July 1, 1901, balance unexpended		$5,233.00
June 30, 1902, amount expended during fiscal year		4,477.79
July 1, 1902, balance unexpended		755.21
July 1, 1902, outstanding liabilities		23.00
July 1, 1902, balance available		732.21

Emplacements for two 12-inch guns on disappearing carriages.

July 1, 1901, balance unexpended		$7,868.54
January 1, 1902, transferred to other work	$7,000.00	
March 25, 1902, transferred to other work	368.20	
June 30, 1902, amount expended during fiscal year	290.00	
		7,658.20
July 1, 1902, balance unexpended and available		210.34

Emplacement for one 12-inch gun on nondisappearing carriage.

July 1, 1901, balance unexpended		$60,000.00
November 14, 1901, received on account of refundment for hire of teams		49.33
		60,049.33
June 30, 1902, amount expended during fiscal year		56,648.30
July 1, 1902, balance unexpended		3,401.03
July 1, 1902, outstanding liabilities	$549.41	
July 1, 1902, amount covered by uncompleted contracts	2,190.00	
		2,739.41
July 1, 1902, balance available		661.62

Mortar battery, sixteen 12-inch mortars.

July 1, 1901, balance unexpended		$2,424.10
January 1, 1902, transferred to other work	$887.19	
June 30, 1902, amount expended during fiscal year	1,464.84	
		2,352.03
July 1, 1902, balance unexpended		72.07
July 1, 1902, outstanding liabilities		10.15
July 1, 1902, balance available		61.92

Installation of searchlight.

July 1, 1901, balance unexpended		$2.36
June 30, 1902, amount expended during fiscal year		2.36

Range-finding station, type B.

December 31, 1901, amount allotted		$450.00
June 30, 1902, amount expended during fiscal year		450.00

Electrical connections, emplacements 6 and 7.

March 6, 1902, amount allotted	$375.00
June 30, 1902, amount expended during fiscal year	375.00

SITES FOR FORTIFICATIONS AND SEACOAST DEFENSES.

March 31, 1902, amount allotted	$2.70
June 30, 1902, amount expended during fiscal year	2.70

PRESERVATION AND REPAIR OF FORTIFICATIONS.

July 1, 1901, balance unexpended		$8,445.40
Amounts transferred to other works on account of cement received, as follows:		
December 31, 1901	$156.78	
January 31, 1902	273.78	
June 30, 1902, amount expended during fiscal year	7,350.83	
		7,781.39
July 1, 1902, balance expended		664.01
July 1, 1902, outstanding liabilities		305.99
July 1, 1902, balance available		358.02

MISCELLANEOUS.

Shelters for Lewis range finders.—At the close of the last fiscal year the following range-finder stations, type A, were completed and turned over to the artillery:

On the north side of harbor, two battery commanders' stations and one fire commander's station.

On islands in harbor, one battery commander's station.

On south side of harbor, four battery commanders' stations.

During the year no active operations were in progress.

On December 31, 1900, the Department made an allotment for constructing a battery commander's station for one of the 12-inch batteries. This structure was to be located in a position selected by the Board of 1899, and was to be built on a tower. The artillery officers stationed at San Francisco Harbor, including the artillery district commander and the artillery inspector, and the district engineer officer did not approve of the site selected by the Board, and on May 5, 1902, the district engineer reported the fact to the Chief of Engineers and recommended another position, which was an alternative site selected by the Board, and that the structure be built in accordance with the approved plans for structure for high sites as shown in Mimeograph 47 from the office of the Chief of Engineers. The Chief of Engineers requested that a joint report by the artillery district commander and the district engineer officer be submitted recommending a location for the shelter in question. This joint report was forwarded on June 27, 1902, and at the close of the fiscal year had not been acted upon by the Department at Washington.

Instructions were received to submit plans and estimates for the remaining shelters provided for by the approved project of the Board of 1899. At the close of the fiscal year these plans and estimates were being prepared.

Datum beacons for range finders.—At the close of the last fiscal year the work of installing the beacons had been completed.

The work of installing the beacon on the north side of the harbor was commenced and completed during the year.

Material for base-end houses.—An allotment was made by the Chief of Engineers for furnishing material for base-end houses at the Presidio, the work of constructing the houses to be done by post labor. This material was purchased at a cost of $39.18, and was transferred to the Artillery Corps.

Steam vessel.—At the close of the last fiscal year the condition of the work was as follows: The frames were all steamed and erected; ceiling was done; clamp and bilge strakes were in; deck frames, including hanging knees and chocks, were in; garboard and shear strakes were in; engine and boiler frames were erected; 20 per cent of the deck plank was done; engines were 90 per cent done; boiler not begun on account of machinists' strike.

The hull was completed by the contractor and launched on November 26, 1901. The continuance of the machinists' strike during the summer delayed the construction of the vessel; it stopped all work on boiler and engines. In September authority was given by the Secretary of the Navy to build the boiler at the Mare Island Navy-Yard. Work was begun immediately and it was completed in December. The engines and boiler were installed and the vessel given a trial trip on December 31, 1901. During the trip the engines worked very smoothly, the vessel was steady, and the trial was considered successful. The contractor then completed the painting and upholstering of cabin and interior finishing, and turned over the boat to the Government on January 9, 1902.

The principal dimensions of the vessel are as follows: Length over all, 77 feet 6 inches; width, 18 feet; load draft, 8 feet. The gross tonnage is 110 tons; speed, 10 miles per hour; indicated horsepower of engines, 113.

The boat was named the *Gen. Alexander*, in honor of the late distinguished engineer officer, Gen. B. S. Alexander, Corps of Engineers, U. S. Army.

Supplies for seacoast defenses.—During the year electrical materials were purchased by the Engineer Department and transferred to the artillery for the batteries.

Money statements.

GUN AND MORTAR BATTERIES.

Battery commander's station.

December 31, 1901, amount allotted	$2,100.00
July 1, 1902, balance unexpended and available	2,100.00

Datum beacons for range finders.

July 1, 1901, balance unexpended	$712.50
June 30, 1902, amount expended during fiscal year	712.50

Materials for base-end houses.

June 6, 1902, amount allotted	$49.34
Amount withdrawn	10.16
July 1, 1902, balance unexpended	39.18
July 1, 1902, outstanding liabilities	39.18

Steam vessel.

July 1, 1901, balance unexpended	$6,923.31
January 1, 1902, amount transferred from other works	7,887.19
March 25, 1902, amount transferred from other work	368.20
	15,178.70
June 30, 1902, amount expended during fiscal year	15,178.70

SUPPLIES FOR SEACOAST DEFENSES.

July 1, 1901, balance unexpended	$907.75
June 30, 1902, amount expended during fiscal year	248.88
July 1, 1902, balance unexpended and available	658.87

Abstract of contracts in force June 30, 1902.

Contract for electric-lighting plant:
Name of contractor: Henshaw, Bulkley & Co.
Date of approval: January 18, 1902.
Date of commencement: February 14, 1902.
Date of completion: April 5, 1902.
Price: $2,190.

Emergency contract for moving six 12-inch mortar carriages and base rings:
Name of contractor: R. Delos Noble.
Date of commencement: The moving of each carriage to commence within five days after notification of its arrival on beach.
Date of completion: The moving of each carriage to be finished within twenty-five days after notification of its arrival on beach.
Rates: $562.50 for each carriage and base ring; total, $3,375.

Emergency contract for moving two 12-inch gun carriages and base rings:
Name of contractor: George Davis.
Date of commencement: The moving of each carriage to commence immediately upon notification of its arrival upon the beach.
Date of completion: To be completed within five days after notification of its arrival on the beach.
Rates: $1,250 for each carriage and base ring; total, $2,500.

TORPEDO DEFENSE.

During the fiscal year a small amount of torpedo material which had become obsolete was shipped to the Depot at Willets Point.

In January, 1902, 43 panes of glass were replaced in the windows of the torpedo shed, and the windows in the shed on the side nearest the naval training school were covered with wire screens to prevent similar accidents in the future.

In March, 1902, the roof of the torpedo shed, which had been damaged by a severe windstorm, was repaired.

The torpedo shed, tank house, and various casemates at different points in the bay are in good condition.

The torpedo defense of San Francisco has not yet been turned over to the artillery.

Money statement.

July 1, 1901, balance unexpended at end of last fiscal year	$311.99
October 10, 1901, amount allotted	180.00
January 11, 1902, amount allotted	280.00
April 18, 1902, amount allotted	150.00
	921.99
June 30, 1902, amount expended during fiscal year	894.23
July 1, 1902, balance unexpended and available	27.76

2 W.

DEFENSES OF MOUTH OF COLUMBIA RIVER, OREGON AND WASHINGTON.

Officer in charge, Capt. William C. Langfitt, Corps of Engineers; Division Engineers, Col. Jared A. Smith, Corps of Engineers, until September 23, 1901; Lieut. Col. David P. Heap, Corps of Engineers, from September 23, 1901, to September 30, 1901; and Lieut. Col. William H. Heuer, Corps of Engineers, since September 30, 1901.

At the beginning of the present fiscal year the condition of the work was as follows:

Six emplacements for 10-inch rifles on disappearing carriages.—These emplacements had been entirely completed, the carriages and guns mounted, and the battery was in charge of the artillery.

Emplacements for eight 12-inch mortars.—The mortar battery had been fully completed, the carriages and mortars mounted, and the battery was in charge of the artillery.

Two emplacements for 6-inch rifles on disappearing carriages, model 1898, site No. 1.—The engineering work on these had been completed, the carriages mounted, and the battery was in charge of the artillery. The guns had not been received.

Two emplacements for 3-inch rapid-fire guns, site No. 1.—These had been completed, the guns mounted, and the battery was in charge of the artillery.

One emplacement for 3-inch rapid-fire gun, site No. 1.—The engineering work on this had been entirely completed, and the emplacement was in charge of the artillery. The base casting, mount, and gun had not been delivered.

Two emplacements for 6-inch rapid-fire guns on pedestal mounts, Site No. 1.—On June 3, 1901, an allotment of $29,000 was made from the appropriation for "Gun and Mortar Batteries," act of March 1, 1901, for the construction of these two emplacements for 6-inch rapid-fire guns, on Ordnance Department pedestal mounts. The work of excavation of the site had been commenced, the 15-inch smoothbore gun was moved from its platform to the banquette tread entirely clear of the emplacements to be built, and the construction material was being assembled.

Electric-light station, Site No. 1.—This had been finished and transferred to the artillery. The plant consists of one 56½-kilowatt Westinghouse generator, with switchboard and necessary instruments, belt driven by a 65-horsepower "Ideal" engine, to which steam is furnished by a new vertical boiler, installed in August, 1901.

Mining casemate, Site No. 1.—This had been completed, with all shelves, tables, etc., in place, and was transferred to the artillery.

Torpedo storehouse.—The storehouse had been completed and transferred to the artillery, including all submarine-mining material stored therein.

Cable tanks.—Two of these, with covering sheds, overhead traveler, and railroad connection, had been fully completed and all submarine cables stored and turned over to the artillery.

Battery commander's station, type A, Site No. 1.—This had been completed and was in charge of the artillery.

Two emplacements for 8-inch rifles on disappearing carriages.—These had been completed, the carriages and guns mounted, and the battery was in charge of the artillery.

Emplacement for one 8-inch rifle on experimental disappearing carriage.—The engineering work in this had been completed, the carriage and gun mounted, and the emplacement was in charge of the artillery.

Two emplacements for 6-inch rifles on disappearing carriages, model 1898, site No. 2.—The engineering work on these emplacements had been completed and the battery was in charge of the artillery. The carriages were mounted, but the guns had not been received.

Three emplacements for 3-inch rapid-fire guns, site No. 2.—The engineering work on these emplacements had been fully completed, and the battery was in charge of the artillery. The base castings, mounts, and guns had not been received.

Electric-light station, Site No. 2.—All work on this had been finished and the plant transferred to the artillery. It consists of one 16-brake horsepower Hornsby-Akroyd oil engine and one 11½-kilowatt Westinghouse generator, with switchboard and all necessary instruments, switches, etc.

Mining casemate, Site No. 2.—This had been completed, with shelves, tables, etc., in place, and turned over to the artillery.

Battery commander's station, type A, site No. 2.—This had also been completed and was in charge of the artillery.

OPERATIONS DURING THE FISCAL YEAR.

Two emplacements for 6-inch rapid-fire guns, on pedestal mounts, site No. 1.—From the allotment of $29,000, made on June 3, 1901, work on these emplacements had just commenced at the beginning of the fiscal year. They were entirely completed, and turned over to the artillery on January 17, 1902. The chain ammunition hoists were installed, as was also the electric-light plant. This consists of a type E 13 storage battery, 53 elements in glass jars, manufactured by the Electric Storage Battery Company, of Philadelphia, Pa. This storage battery also serves the one 3-inch emplacement in the old fort and the two 3-inch emplacements on the right of the old fort, the conductors being lead-covered cables, laid underground. It is charged from the central electric station through lead-covered, underground conductors. The mounts and guns for these emplacements have not yet been delivered.

Electric-light station, Site No. 1.—The original, locomotive type, 80-horsepower boiler installed with the electric plant was condemned and was replaced by a vertical boiler of somewhat greater capacity, which occupies but one-half the space of the boiler room, thus permitting the duplicating of this part of the plant if desired.

Preservation and repair of fortifications.—A few unimportant leaks in passages were stopped in the 10-inch battery and in the 6-inch battery on its right, and the three 8-inch emplacements were repaired by asphalting the parapets over magazines and shell room and cutting out and asphalting the joints of the loading platforms. A small slide in the parapet of the 6-inch battery was also repaired.

Cracks in the concrete aprons of the mortar battery caused leaks in the shell rooms. They were stopped by asphalting the aprons.

Supplies for seacoast defenses.—From the balance available of the

allotment of $800, various electrical supplies have been furnished the commanding officer.

The locomotive-type boiler, which was installed with the electric plant in the central station, had for a period of nearly one year caused trouble from leaks until they became so serious as to call for a new boiler. An allotment of $1,400 was made on July 9, 1901, for the purchase and installation of a new boiler. This boiler is of the vertical type and has a capacity of 80 horsepower at 100 pounds pressure, but as it is allowed to carry 160 pounds, its capacity can be considerably increased above 80 horsepower. It was installed, tested, and turned over to the artillery on September 2, 1901.

Miscellaneous.—An estimate was submitted under date of July 19, 1901, showing proposed location and cost of purchase and installation of two 36-inch and six 24-inch searchlights allotted for this district.

To comply with instructions, detailed plans, with estimate of cost, were submitted on November 20, 1901, for changing all the shot lifts not chain hoists and providing the older batteries with suitable chain hoists of the adopted type.

Detailed drawings, with estimates of cost for installation, of telantographs for guns of 8-inch caliber or over, were submitted on April 23, 1902, and estimate for cost of laying cables from mining casemates to a point beyond low water, for drill and for testing purposes, was submitted on April 24, 1902.

These works have been in the efficient charge of Assistant Engineer G. B. Hegardt, and attention is invited to his report. (See Appendix Z Z 10.)

Money statements.

GUN AND MORTAR BATTERIES.

Ten-inch battery, emplacements 5 and 6.

July 1, 1901, balance unexpended		$1,732.39
June 30, 1902, amount expended during fiscal year	$273.39	
May 28, 1902, balance unexpended deposited to the credit of the Treasurer United States	504.52	
Withdrawn from Treasury	954.48	
		1,732.39

Emplacements for two 6-inch rapid-fire guns, Ordnance Department pedestal mounts, Site No. 1.

July 1, 1901, balance unexpended	$29,000.00
June 30, 1902, amount expended during fiscal year	28,508.06
July 1, 1902, balance unexpended and available	491.94

Emplacement for one 3-inch rapid-fire gun, Site No. 1.

July 1, 1901, balance unexpended	$101.95
May 28, 1902, amount deposited to credit of Treasurer United States	51.95
July 1, 1902, balance reserved for setting base casting	50.00

Three-inch battery, three emplacements, Site No. 2.

July 1, 1901, balance unexpended		$293.50
June 30, 1902, amount expended during fiscal year	$2.09	
May 28, 1902, amount deposited to credit of Treasurer United States	165.36	
		167.45
July 1, 1902, balance reserved for setting base castings		126.05

PRESERVATION AND REPAIR OF FORTIFICATIONS.

Prevention of leakage in emplacements.

July 1, 1901, balance unexpended	$736.70
June 30, 1902, amount expended during fiscal year	652.34
July 1, 1902, balance unexpended and available	84.36

SUPPLIES FOR SEACOAST DEFENSES.

July 1, 1901, balance unexpended	$464.84
July 9, 1901, allotted for new boiler for electric-light plant	1,400.00
	1,864.84
June 30, 1902, amount expended during fiscal year	1,484.30
July 1, 1902, balance unexpended and available	380.54

2 X.

DEFENSES OF PUGET SOUND, WASHINGTON.

Officer in charge, Maj. John Millis, Corps of Engineers; Division Engineers, Col. Jared A. Smith, Corps of Engineers, until September 23, 1901; Lieut. Col. David P. Heap, Corps of Engineers, from September 23, 1901, to September 30, 1901, and Lieut. Col. William H. Heuer, Corps of Engineers, since September 30, 1901.

Emplacements for five 10-inch and two 12-inch guns on nondisappearing carriages.—At the beginning of the year these emplacements were practically completed, except the electric-light plant. During the year one 12-inch gun was received and the gun and carriage were mounted.

General plans and estimates for the electrical service were prepared.

The battery was transferred to the artillery on June 16, 1902.

Emplacements for four 10-inch guns on disappearing carriages.—At the beginning of the year these emplacements were practically completed, except the electric-light plant, and the guns were mounted. During the year railings were placed about the gun-platform stairways, and several minor repairs were made.

General plans and estimates for the electrical service were prepared.

The emplacements were transferred to the artillery on June 16, 1902.

Emplacements for three 10-inch guns on disappearing carriages.—At the beginning of the year excavation for foundation was completed and plant was ready for work. During the year construction work was actively in progress except when suspended waiting for steel beams. There was a delay of over four months on this account. The rough concrete has been completed from the left flank of No. 7 to center of No. 6, and to the top of the forms over the rest of the work. Construction is now actively in progress.

Two 10-inch guns and two disappearing carriages have been received.

Emplacements for two 12-inch and four 10-inch guns on nondisappearing carriages.—At the beginning of the year these emplacements were practically completed, except the electric-light plant, and the

guns were mounted. During the year some additional work was done on the traverses, roads, and gutters, and repairs were made to latrines. Some fixtures were placed in the rooms.

General plans and estimates for the electrical service were prepared.

The battery was transferred to the artillery on June 30, 1902.

Mortar battery No. 1.—At the beginning of the year this battery was practically completed, except lighting plant, and the mortars were mounted. During the year some minor repairs were made.

General plans and estimates for the electrical service were prepared.

The battery was transferred to the artillery on June 16, 1902.

Mortar battery No. 2.—At the beginning of the year this battery was practically completed, except the electric-light plant. During the year some repair work was done on slopes and roads. One mortar and carriage were dismounted and the carriage was sent away for repairs.

General plans and estimates for the electrical service were prepared.

The battery was transferred to the artillery on June 16, 1902.

Mortar battery No. 3.—At the beginning of the year concrete floors of this battery were in place, and the work was ready for placing forms. Eight mortar carriages were on hand.

During the year the battery was built. It was ready for transfer to the artillery on June 30, but the transfer was not effected. The eight mortar carriages were mounted by the artillery.

General plans and estimates for the electrical service were prepared.

Emplacements for three 8-inch guns on disappearing carriages.—At the beginning of the year this battery was nearly finished, except electric-lighting plant.

During the year most of the finishing work was done and the plant removed. Two disappearing carriages were received.

Emplacements for two 6-inch rapid-fire guns.—Plans and estimates for these emplacements were completed and approved, but the funds were afterwards withdrawn. The site was cleared.

Emplacements for 5-inch rapid-fire guns on balanced-pillar mounts.—There are two emplacements at each of the sites 1, 2, and 4. At the beginning of the year these were practically complete, except electric-light plants. Some finishing work has been done at Site No. 2. The gun mounts are all in place. No guns have been received.

General plans and estimates for the electrical service were prepared.

The emplacements at Sites Nos. 1 and 2 were transferred to the artillery on June 16, 1902, and those at Site No. 4 on June 30.

Emplacements for three 5-inch rapid-fire guns, mounts not determined.—At the beginning of the year these were partly built, and work was suspended by direction of the Chief of Engineers. No work has been done during the year.

Emplacements for two 3-inch rapid-fire guns.—At the beginning of the year construction work was in progress.

During the year the battery was practically finished except electric-lighting plant.

Emplacements for four 3-inch rapid-fire guns.—At the beginning of the year the work was ready for laying concrete.

During the year the battery was practically finished except electric-lighting plant and some painting.

Emplacements for two 3-inch rapid-fire guns.—At the beginning of the year the work was ready for laying concrete.

During the year all rough concrete was placed and doors were hung. Pavements and general finishing remain to be done. A rocky bluff in rear is to be removed.

Storehouse for torpedo material.—At the beginning of the year the building was practically completed, except heating and lighting plant, and the material on hand was stored in it.

Nothing has been done during the year except preparation of estimates for heating and lighting and general care of the building and contents.

Money statements.

GUN AND MORTAR BATTERIES.

Emplacements for five 10-inch and two 12-inch guns on nondisappearing carriages.

July 1, 1901, balance unexpended	$747.19
June 30, 1902, amount expended during fiscal year	712.34
Deposited to credit Treasurer United States	34.85

Emplacements for three 10-inch guns on disappearing carriages.

[Allotment made for two emplacements.]

July 1, 1901, balance unexpended		$71,180.23
Amount allotted since		17,000.00
		88,180.23
June 30, 1902, amount expended during fiscal year	$34,053.47	
Amount transferred	510.00	
		34,563.47
July 1, 1902, balance unexpended		53,616.76
July 1, 1902, outstanding liabilities		3,172.21
July 1, 1902, balance available		50,444.55

[Allotment made for one emplacement.]

Allotted during fiscal year	$23,000.00
June 30, 1902, amount expended during fiscal year	11,027.62
July 1, 1902, balance unexpended	11,972.38
July 1, 1902, outstanding liabilities	3,406.78
July 1, 1902, balance available	8,565.60

Mortar battery No. 3.

July 1, 1901, balance unexpended	$49,414.15
Received by transfer	1,025.10
Received on account of overpayment	.85
	50,440.10
June 30, 1902, amount expended during fiscal year	48,097.89
July 1, 1902, balance unexpended	2,342.21
July 1, 1902, outstanding liabilities	2,152.35
July 1, 1902, balance available	189.86

Emplacements for three 8-inch guns on disappearing carriages.

July 1, 1901, balance unexpended	$2,128.42
June 30, 1902, amount expended during fiscal year	2,128.42

Emplacements for two 6-inch rapid-fire guns.

July 1, 1901, balance unexpended	$30,000.00
June 30, 1902, amount transferred during fiscal year	30,000.00

Emplacements for two 6-inch rapid-fire guns.

July 1, 1901, received by transfer	$30,000.00
June 30, 1902, amount expended during fiscal year	500.00
Amount withdrawn from Treasury	29,500.00

Emplacements for 5-inch rapid-fire guns on balanced-pillar mounts, Site No. 3.

July 1, 1901, balance unexpended	$1,276.24
June 30, 1902, amount expended during fiscal year	1,276.24

Emplacements for three 5-inch rapid-fire guns, mounts not determined.

[Allotment made for two emplacements only.]

July 1, 1901, balance unexpended		$9,425.44
June 30, 1902, amount expended during fiscal year	$2,560.40	
Amount withdrawn	4,200.00	
Amount deposited to credit Treasurer United States	2,665.04	
		9,425.44

Emplacements for two 3-inch rapid-fire guns.

July 1, 1901, balance unexpended	$3,209.00
June 30, 1902, amount expended during fiscal year	3,209.00

Emplacements for four 3-inch rapid-fire guns.

July 1, 1901, balance unexpended	$11,184.55
June 30, 1902, amount expended during fiscal year	11,184.55

Emplacements for two 3-inch rapid-fire guns.

July 1, 1901, balance unexpended	$3,023.64
Received by transfer	720.00
	3,743.64
June 30, 1902, amount expended during fiscal year	3,585.78
July 1, 1902, balance unexpended and available	157.86

Fire and battery commanders' stations.—At the beginning of the year contracts had been made for the erection of two fire commanders' stations and two battery commanders' stations, all low-site type. During the year these were all built complete and sites graded around them. One fire commander's station and two battery commanders' stations, high-site type, were under construction by hired labor. These were so far advanced as to be available for use had it been necessary to use them at the close of the year, but they were unfinished owing to delay in receipt of metal work and glass for the roofs. Temporary shingle roofs were provided.

Money statements.

GUN AND MORTAR BATTERIES.

Fire commander's station, Site No. 1.

July 1, 1901, balance unexpended		$4,932.25
June 30, 1902, amount expended during fiscal year		3,358.19
July 1, 1902, balance unexpended		1,574.06
July 1, 1902, outstanding liabilities	$10.00	
July 1, 1902, amount covered by uncompleted contracts	1,030.00	
		1,040.00
July 1, 1902, balance available		**534.06**

Fire commander's station, Site No. 2.

July 1, 1901, balance unexpended		$2,370.00
June 30, 1902, amount expended during fiscal year		995.43
July 1, 1902, balance unexpended		1,374.57
July 1, 1902, outstanding liabilities		1,082.76
July 1, 1902, balance available		291.81

Fire commander's station, Site No. 4.

July 1, 1901, balance unexpended		$4,870.50
June 30, 1902, amount expended during fiscal year	$2,729.80	
Amount transferred	168.30	
		2,898.10
July 1, 1902, balance unexpended		1,972.40
July 1, 1902, outstanding liabilities	$2.18	
July 1, 1902, amount covered by uncompleted contracts	1,030.00	
		1,032.18
July 1, 1902, balance available		940.22

Battery commander's station, Site No. 2.

July 1, 1901, balance unexpended		$6,000.00
June 30, 1902, amount expended during fiscal year		2,205.20
July 1, 1902, balance unexpended		3,794.80
July 1, 1902, outstanding liabilities		2,317.86
July 1, 1902, balance available		1,476.94

Battery commanders' stations, Site No. 4.

July 1, 1901, balance unexpended		$10,112.55
June 30, 1902, amount expended during fiscal year	$4,960.93	
Amount transferred	346.80	
		5,307.73
July 1, 1902, balance unexpended		4,804.82
July 1, 1902, outstanding liabilities	$4.77	
July 1, 1902, amount covered by uncompleted contracts	2,060.00	
		2,064.77
July 1, 1902, balance available		2,740.05

Special allotments for auxiliary work.—Work under several special allotments has been in progress during the year. In each case, excepting under allotments for electric lighting, the work has been practically finished. The allotments, the purposes for which they were made, with money statements, are as follows:

Money statements.

CLEARING GROUND AND REMOVING CONSTRUCTION PLANT, SITE NO. 1.

July 1, 1901, balance unexpended	[a] $499.25
June 30, 1902, amount expended during fiscal year	100.00
July 1, 1902, balance unexpended	399.25
Outstanding liabilities	104.25
July 1, 1902, balance available	295.00

[a] Included in money statement for mortar battery No. 2 in last annual report.

ELECTRIC PLANT FOR MORTAR BATTERY NO. 1.

July 1, 1901, balance unexpended	[a] $5,800.00
June 30, 1902, amount expended during fiscal year	280.08
July 1, 1902, balance unexpended	5,519.92
July 1, 1902, outstanding liabilities	83.33
July 1, 1902, balance available	5,436.59

GRADING AND ROAD CONSTRUCTION AT SITE NO. 1.

July 1, 1901, balance unexpended	$1,220.55
June 30, 1902, amount expended during fiscal year	1,220.55

ELECTRIC PLANT AT MORTAR BATTERY NO. 2.

July 1, 1901, balance unexpended	$6,000.00
June 30, 1902, amount expended during fiscal year	282.14
July 1, 1902, balance unexpended	5,717.86
July 1, 1902, outstanding liabilities	83.33
July 1, 1902, balance available	5,634.53

ROAD CONSTRUCTION AT MORTAR BATTERY NO. 2.

July 1, 1901, balance unexpended		$1,222.45
June 30, 1902, amount expended during fiscal year	$502.45	
Amount transferred	720.00	
		1,222.45

ELECTRIC PLANT AT MORTAR BATTERY NO. 3.

July 1, 1901, balance unexpended	[b] $3,000.00
June 30, 1902, amount expended during fiscal year	273.48
July 1, 1902, balance unexpended	2,726.52
July 1, 1902, outstanding liabilities	83.34
July 1, 1902, balance available	2,643.18

ROAD BETTERMENT AT SITE NO. 4.

July 1, 1901, balance unexpended	$217.64
June 30, 1902, allotted during fiscal year	900.00
	1,117.64
June 30, 1902, amount expended during fiscal year	1,117.64

LATRINES AND WATER-SUPPLY SYSTEM AT SITE NO. 4.

July 1, 1901, balance unexpended	$1,759.27
June 30, 1902, amount expended during fiscal year	1,759.27

PRESERVATION AND REPAIR OF FORTIFICATIONS.

Site No. 1.

July 1, 1901, balance unexpended	$1,980.00
June 30, 1902, amount expended during fiscal year	1,980.00

Site No. 3.

July 1, 1901, balance unexpended	$423.10
June 30, 1902, amount expended during fiscal year	423.10

[a] Included in money statement for mortar battery No. 2 in last annual report.
[b] Above amount was included in money statement for mortar battery No. 3 in last annual report.

Site No. 4.

July 1, 1901, balance unexpended	$480.57
June 30, 1902, amount expended during fiscal year	480.57

For care of and putting torpedo material in condition for permanent storage.

June 30, 1902, allotted during fiscal year	$1,020.00
June 30, 1902, amount expended during fiscal year	1,020.00

Care of batteries.

June 30, 1902, allotted during fiscal year	$575.10
June 30, 1902, amount expended during fiscal year	575.10

Light-house at Admiralty Head, Washington.—The act of March 3, 1899, making appropriation for fortifications, authorized an expenditure of not to exceed $8,000 from the funds appropriated by that act for moving or reconstructing the light-house station at Admiralty Head, Washington. The old light-house being unfit for moving, plans and specifications for a new station were prepared by the light-house department. The construction of the building under this office, by hired labor and purchase of material under existing regulations, was authorized by the Chief of Engineers, December 24, 1901. At the close of the year most of the material except the lantern was on hand. The foundation and cistern were completed and walls of building and tower were about two-thirds completed. The woodwork was well up with the masonry.

Money statement.

July 1, 1901, balance unexpended	$7,926.92
June 30, 1902, amount expended during fiscal year	3,067.85
July 1, 1902, balance unexpended	4,859.07
July 1, 1902, outstanding liabilities	592.33
July 1, 1902, balance available	4,266.74

Transporting, mounting, and painting ordnance at Site No. 1.—At the beginning of the fiscal year five 10-inch guns and carriages, one 12-inch gun and carriage, sixteen 12-inch mortars and carriages, and two carriages for 5-inch rapid-fire guns were mounted.

One 12-inch gun and carriage were mounted, and all guns, mortars, and carriages, except 5-inch rapid-fire carriages, were painted during the year.

Ordnance was turned over to artillery on June 16, 1902.

Money statement.

July 1, 1901, balance unexpended	$506.60
June 30, 1902, allotted during fiscal year	1,000.00
	1,506.60
June 30, 1902, amount expended during fiscal year	1,506.60

Supplies for seacoast defenses.—The sum of $500, available at the end of the last fiscal year, for the purchase of supplies for electrical plants, was withdrawn.

2 Y.

DEFENSES OF SAN JUAN, PORTO RICO.

Officers in charge, Capt. Clement A. F. Flagler, Corps of Engineers, until May 12, 1902, and Capt. Francis R. Shunk, Corps of Engineers, since that date.

Preservation and repair of fortifications.—Estimates of the cost of certain needed repairs to the defensive works of San Juan, P. R., were approved by the Chief of Engineers in 1901. This work was done by hired labor. Besides numerous minor repairs, the following of the more important items may be mentioned.

El Morro and outworks: Sentry box on lower level, damaged by small shell during bombardment, was repaired; ordnance storeroom was refloored in cement (2,100 square feet), whitewashed, and new doors hung; ventilator of ammunition hoist was reglazed and repaired; ventilator hole was cut to main prison; floors of ramps were patched with concrete; old dilapidated brick house on lower level was torn down; window was made in guard room; and iron door was put on storeroom under tower.

San Cristobal and outworks: Floor of main postern to ditch was repaired throughout; barbed-wire fences were built across south ends of ditches; stairs were rebuilt leading from main ditch to covered way; main entrance ramp was refloored throughout with cement; wooden bridge was rebuilt, and old traverses repaired at Abanico battery; new bridge was painted, walls repaired, and new door put on at Princesa battery.

Money Statement.

July 1, 1901, balance unexpended	$1,600.00
December 31, 1901, amount allotted by Chief of Engineers	500.00
	2,100.00
June 30, 1902, amount expended during fiscal year	2,052.50
July 1, 1902, balance unexpended and available	47.50

Range-finder station.—On February 25, 1901, the Chief of Engineers approved a project for the conversion of an old semaphore tower on Fort El Morro, San Juan, P. R., into a peace practice station for type A range and position finder. Materials were advertised for, and in October, 1901, the work was commenced. The roof was removed from old tower and walls razed to the proper sight level; brick pier to support instrument was built; the new structure was then erected in accordance with the approved design, with galvanized-iron roof, shutters, ceiled throughout, painted, and oiled. By February, 1902, it was completed and ready for the instrument, which has not yet arrived. The observation room is octagonal in form, spacious, and well ventilated, having excellent exposure to the sea breeze. The work was done by hired labor.

Money statement.

July 1, 1901, balance unexpended	$1,000.00
June 30, 1902, amount expended during fiscal year	930.14
July 1, 1902, amount unexpended and available	69.86

(This balance is retained to defray cost of installation of instrument.)

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APPENDIX No. 3.

POST OF WASHINGTON BARRACKS, DISTRICT OF COLUMBIA.—ENGINEER SCHOOL OF APPLICATION, U. S. ARMY—THIRD BATTALION OF ENGINEERS—ENGINEER DEPOT, WASHINGTON BARRACKS.

REPORT OF MAJ. W. M. BLACK, CORPS OF ENGINEERS, FOR THE FISCAL YEAR ENDING JUNE 30, 1902.

ENGINEER SCHOOL OF APPLICATION,
UNITED STATES ARMY,
Washington Barracks, Washington, D. C., July 30, 1902.

GENERAL: I have the honor to forward herewith, in duplicate, the annual report on the post of Washington Barracks, D. C., the Engineer School of Application, U. S. Army, the Third Battalion of Engineers, and the Engineer Depot, Washington Barracks, for the fiscal year ending June 30, 1902.

Very respectfully, your obedient servant,

W. M. BLACK,
Major, Corps of Engineers, Commanding.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

I.—POST OF WASHINGTON BARRACKS, DISTRICT OF COLUMBIA.

The reservation on which the post of Washington Barracks is situated is located on Greenleafs Point, at the southern extremity of the city of Washington, lying between the Washington channel of the Potomac River and the James Creek Canal. The total area of the reservation is 69 acres, of which about 60 acres are available for use, the balance, lying along the James Creek Canal, being low and marshy. Ten of the 60 acres available for use are reserved for the general hospital, situated at the northwest corner of the post. This hospital forms an entirely separate command as far as its administration is concerned, its only relation with the post being that in the absence of a post hospital the post sick are taken there.

Under contract made during the past fiscal year, the lowlands subject to overflow are being raised and graded and on the east and south sides an area of shoal water containing a heavy growth of marsh grass, which has long been complained of as unsanitary, is being filled and protected by a suitable sea wall. The improvements when finished will increase the area available for post uses by about 15 acres.

In his report dated April 29, 1901, Major-General Brooke recommended that this post be reconstructed on modern and improved plans, almost all of the buildings having been converted from storehouses and shops to their present uses, and being unsuitable in location, arrangement, and construction. The removal of the Engineer School and Depot from Willets Point to Washington Barracks and the location at this post of the Third Battalion of Engineers and the engineer band have made even greater the necessity for the change recommended by General Brooke.

The garrison is crowded and uncomfortable, and there is no proper storage room for the large and valuable quantity of engineer material pertaining to the depot. The valuable models belonging to the Engineer School museum have not been even unpacked, for lack of space. During the past year it was decided to locate the Army War College at the post and to reconstruct it throughout on plans devised by a Board of engineer officers under the advice of Mr. C. F. McKim, of New York, and approved by the Chief of Engineers and by the Secretary of War. Congress at its past session made provision for beginning this work.

To fit the post for occupation by the increased garrison, allotments were made in the fall by the Quartermaster's Department. The funds were expended only for such work as was immediately necessary, and, as far as possible, with a view to the future use in the reconstructed post of the more expensive material bought.

There is no telegraph office on the post, but there is a connection with the city telephone system. Important official telegraph messages are delivered over the telephone, in addition to the regular messenger system.

Four mails are sent out and received daily, except Sunday, on which day there is but one. The mail is carried to and from the branch office on Four-and-a-half street by an enlisted man specially detailed for that purpose.

There is a post telephone system furnished by the Signal Department of the Army. This system, so far as it goes, renders excellent service. Due to the length of the post, however, it should be enlarged.

The post is supplied with water from the city mains, and no complaint, except that which applies to the whole city, can be made.

The lighting of the post is by means of gas. The pressure is poor and the lighting unsatisfactory, as well as very expensive.

There is a site and butt for a target range on the post. Authority for use of range for distances up to 200 yards was granted on July 2 of this year by the Secretary of War.

The garrison of the post during the portion of the year beginning October 10, 1901, has consisted of engineer troops of the Third Battalion of Engineers—Companies I, K, and L and the engineer band since October 10, and company M since December 25, 1901.

Officers of the Corps of Engineers on duty with the battalion during the year are reported later. Other officers have been on duty at the post since the arrival of the battalion in October, as follows:

Capt. Edward Burr, Corps of Engineers, joined November 13, 1901; instructor in electrics.

Capt. Charles H. McKinstry, Corps of Engineers, joined November 10, 1901; instructor in civil engineering.

Capt. William V. Judson, Corps of Engineers, joined November 6, 1901; instructor in military engineering.

Capt. John Hamilton Stone, Medical Department, joined May 2, 1902; post surgeon.
Capt. Morton J. Henry, Subsistence Department, relieved October 31, 1901; post commissary.
First Lieut. Joseph H. Ford, Medical Department, joined October 31, 1901, relieved May 10, 1902; post surgeon.
First Lieut. Conrad E. Koerper, Medical Department, joined October 6, 1901, relieved November 1, 1901; post surgeon.

SUBPOST OF FORT FOOTE, MARYLAND.

This post is situated on the Maryland bank of the Potomac River about 8 miles south of the city of Washington. It has a total area of 66 acres. The main portion of the post is a plateau at an average elevation of 80 feet above the river. This plateau is cleared ground and on it are located an old fort and such of the wooden structures built for the accommodation of the garrison as are still standing.

From the plateau the ground slopes away rapidly toward the river on the west and more gradually toward the north, these slopes being heavily wooded. A ravine, in which it is proposed to lay out a 300-yard target range, forms the northeastern boundary, the bottom, which is marshy, being about 50 yards wide. The post lends itself very readily to such drills as are necessary to fit engineer troops for field service, the ravine, with its heavily wooded banks, being an ideal place for bridge construction, while the plateau above may be used for earthworks. Demolitions can be carried on in the old fort. About 5 acres are now under cultivation for the use of the battalion, a detail of 1 noncommissioned officer and 8 men being stationed there for this purpose. This detail is changed each two weeks. The reservation is under the direct supervision of an ordnance sergeant.

Fort Foote has not been garrisoned as a regular post for a number of years, and was placed under the command of the commanding officer at Washington Barracks, for drill purposes, by authority of the Secretary of War, given November 26, 1901.

The water supply is from springs, the water of two of which was analyzed with the following results:

Analysis stated in parts per 100,000.

No. of sample.	Chlorine.	Nitrites.	Nitrates.	Free ammonia.	Albuminoid ammonia.	Required oxygen.	Total solids.
1	1.0	None	Trace	None	0.004	0.060	4
2	.6	None	Trace	None	.0004	.052	6

The post surgeon states "the report shows that both are very pure waters."

The buildings are old and in general in a bad state of repair. An itemized statement follows:

Officers' quarters, two sets; condition fair.
Officers' quarters, two sets; condition poor.
Barracks; condition poor.
Hospital; condition fair.
Guardhouse; condition fair.
Stable; condition fair.
Administration building; condition poor.
Carpenter and blacksmith shop; condition poor.

Storehouse; condition poor.
Bakehouse; condition poor.
Five sets noncommissioned officers' quarters; condition poor.

These buildings were built between 1868 and 1870; cost unknown.

II.—ENGINEER SCHOOL OF APPLICATION, U. S. ARMY.

COMMANDANT.

Maj. William M. Black, Corps of Engineers.

The regulations of this school are to be found in the Army Regulations and in General Orders, Nos. 146 and 155, Headquarters of the Army, series of 1901. No detailed regulations have as yet been adopted.

The name of this school was formerly "The United States Engineer School," but was changed in accordance with General Orders, No. 146, above mentioned.

The period of instruction of officers is two years, beginning October 1. Due to the necessary delay incident to moving the school from Willets Point to Washington Barracks in October, the regular course of instruction did not begin until December 1.

The methods of instruction were by lectures; by a course of reading, the student officers taking notes and submitting them to the instructor; and by preparation of theses and projects on subjects selected by the instructors. At the close of each course, after an examination before the academic staff, the students were rated as "proficient with honor," "proficient," or "deficient," according to their work.

The following statement shows the course of instruction as approved by the Chief of Engineers:

A.—DEPARTMENT OF MILITARY ENGINEERING, INCLUDING ORDNANCE AND ARMOR.

Instructors: Capt. James F. McIndoe, Corps of Engineers, until November 7, 1901; Capt. William V. Judson from that date.

The ten and a half weeks' course of instruction began December 2, 1901, and continued until February 19, 1902.

The following are the titles of subjects studied:

War ships; influence of sea power on land operations; combined operations; seacoast guns and mortars; projectiles; explosives; concrete; harbor defenses; projects for attack and defense; field engineering; duties of engineer officers on staff duty; service of security and information; organization and tactics; care and transportation of troops; the art of war; study of campaigns illustrating the principles of strategy, logistics, and grand tactics.

During the course the student officers were taken to the naval gun foundry at Washington. As a part of the examination in military engineering, each officer was required to prepare a thesis on a subject selected by the instructor.

B.—DEPARTMENT OF CIVIL ENGINEERING.

Instructor: Capt. Charles H. McKinstry, Corps of Engineers.

The course of eight weeks for the first winter's class began December 2, 1901, and ended January 31, 1902.

Details of this course, ordered upon the recommendation of the academic staff, were as follows:

Surveying; applied mechanics; framed structures; materials of construction; roads and pavements; foundations and masonry construction, omitting concrete.

During the course the students were taken to examine the District quarries and stone crushing plant.

The course of eight weeks for the second winter's class began February 20, 1902, and ended April 17, 1902.

Details of the course, ordered upon the recommendation of the academic staff, were as follows:

Canals; improvement of nontidal rivers; improvement of harbors, including tidal rivers, dredging, and light-houses; domestic sanitation; water supply; sewers; plumbing and sewage disposal; estimates, contracts, eminent domain, riparian rights, and office work.

As a part of the examination in both classes each officer was required to prepare a thesis.

C.—Department of Electrics.

Instructors: Capt. Francis R. Shunk, Corps of Engineers, until November 20, 1901, and Capt. Edward Burr, Corps of Engineers, since that date.

The ten weeks' course began February 1, 1902, and ended April 7, 1902.

Details of the course, ordered upon the recommendation of the academic staff, were as follows:

General principles; direct and alternating currents; generators; motors; transformers; storage batteries; conductors; insulators; conduits; arc and incandescent lamps; searchlights; measuring and testing apparatus; telephone; wireless telegraphy; signaling apparatus; lightning protection; applications, including specifications, tests, and management of plant.

During the course the officers made an examination of the several lighting and power plants of this city.

As a part of the examination in electrics, each officer was required to prepare and submit a thesis on a selected subject.

A short course in mechanical engineering was also given both classes.

Due to the fact that the second winter's class had had a portion of the course the preceding year, the time of instruction for the two classes was not the same.

The first winter's course of three weeks began April 8 and ended April 28.

The second winter's course of one and a half weeks began April 19 and ended April 28.

Details of the course of instruction, ordered upon the recommendation of the academic staff, were as follows:

Fuels; boilers; steam engines and accessories; hot-air, gasoline, and oil engines; water motors.

The season of practical instruction during the past year began May 1, 1902. During this season practical instruction was given in photography and reconnaissance under Capt. W. V. Judson, and in surveying and astronomy under Capt. C. H. McKinstry.

The following officers have taken the full course in reconnaissance and photography: Lieuts. E. M. Rhett, A. B. Putnam, A. E. Waldron, M. J. McDonough, W. P. Stokey, J. H. Poole, and H. C. Jewett.

Lieut. E. M. Adams was relieved, after finishing a portion of the course, on account of his assignment as assistant to the post quartermaster by direction of the Chief of Engineers.

Details of the course in reconnaissance, surveying, and photography are as follows:

Reconnaissance.—A road sketch and report (5 miles of road). Reconnaissance of a position, embracing a field map of about 1½ square miles of ground; a report; landscape sketches and photographs.

Surveying.—Practical field work covering method of topographic and hydrographic surveying; railroad work, including curves, turnouts, etc.

Measurement of a base; use of transit, stadia, and level; making and platting soundings, including use of sextant; current measurement.

Photography.—Negatives on dry plates and films; use of developers and intensifiers; silver printing, finishing, and mounting; blue and brown printing; bromide printing.

The following officers, transferred to the Corps of Engineers and assigned to duty at this post, arrived too late to take the regular course of theoretical instruction, but, as stated, took the course in reconnaissance and photography: Lieutenants Putnam, Waldron, McDonough, and Stokey.

During the present season of 1902 practical work in astronomy has been carried on by Lieutenants Rhett, Poole, and Jewett.

The following is the ordinary routine of observations with the several astronomical instruments after reasonable proficiency has been attained by preliminary practice:

Sextant.—Determination of time by single altitude of the sun; time by equal altitudes of the sun; time by single altitude of star.

Transit.—Time by meridian transit of stars, using 8 time and 2 azimuth stars according to method used by Coast and Geodetic Survey.

Zenith telescope.—Latitude, Talcott method.

Lieuts. W. P. Wooten and T. H. Jackson, having finished the prescribed course of two years, were relieved from duty at the Engineer School of Application and were granted diplomas. Lieut. C. S. Smith, who was relieved from duty on September 19, 1901, was also granted a diploma. Lieut. W. D. Connor, quartermaster and commissary, and Lieut. F. C. Boggs, adjutant of the battalion and of the post, took a portion of the course in military engineering, but on account of their other duties found it impossible to continue it in a satisfactory manner.

The following table shows the work completed by the student officers to June 30, 1902:

[c., completed and recommended proficient; n. c., begun but not yet finished; c. h., completed and recommended proficient with honor.]

	Theoretical instruction.				Practical instruction.				Remarks.
	Electrics.	Civil engineering.		Military engineering.	Mechanics.	Surveying.	Astronomy.	Reconnaissance and photography.	
	Winter's course.								
	First.	First.	Second.	Second.					
First Lieutenants.									
Wooten, Wm. P	c.	c.	c. h.	c. h.	c.	c.			Relieved May 1, 1902.
Jackson, Thos. H	c.	c.	c.	c.	c. h.	c.			Relieved from duty with school May 19, 1902.
Adams, E. M	c.	c.			c.				Joined Dec 15, 1901; temporarily relieved from duty with school May 22, 1902.
Rhett, E. M	c.	c.			c.	c.	c.	c.	Joined Oct. 3, 1901.
Putnam, A. B								c.	Joined Mar. 18, 1902.
Waldron, A. E								c.	Joined Mar. 13, 1902.
McDonough, M. J								c.	Joined Mar. 19, 1902.
Stokey, W. P								c.	Joined Mar. 24, 1902.
Second Lieutenants.									
Poole, J. H	c.	c.			c.	c.	c.	c.	
Jewett, H. C	c.	c.			c.	c.	c.	c.	

In addition to the above, with the assistance of Lieut. Col. W. R. Livermore, Corps of Engineers, practical problems in the tactics of a battlefield were studied on two afternoons by the officers attached to the school, using the Livermore American Kriegspiel apparatus.

Although hampered by the move from Willets Point, the fact that this was the first year for each of the instructors and each had to prepare his course, the absence of clerical assistance for the instructors, the absence of any electrical apparatus, the absence of proper school furniture, the necessary alterations in the school building, the lack of models, due to the fact that there is as yet no place at the post where those belonging to the museum can be exhibited and used, and the other obstacles incident to removal and reorganization with insufficient funds, the work of the school has been in the main satisfactory and certainly better than might have been reasonably expected.

The instructors and student officers have shown interest and energy in their work.

The assignment of instructors to the school without company duties permits them to give their time wholly to preparation for and imparting instruction with a minimum of interruptions, and, further, allows the company commanders to devote their full time to the theoretical and practical instruction of the enlisted men of their commands. The advantages of this policy are evident in the marked increase in the amount and character of the instruction given to both student officers and enlisted men and in a degree of efficiency on the part of the men which has elicited praise from higher officers of the service.

Due to the nature of the course and to the constant advances made in the subjects taught, text-books can not be used excepting in the

more elementary portions. This fact entails a great amount of labor for the instructors in preparing proper notes and references for the student officers. In addition, the preparation of the Engineer Manual, of which report is made later, the translation and compilation of new information on engineering subjects for the use of the school and of the Corps of Engineers, and the investigation of special subjects directed by higher authority require a large amount of clerical work, which during the past year has been done to a great extent by the instructors, thus taking time which could be more advantageously employed on a higher class of work. It is hoped that in the future sufficient clerical assistance can be furnished to permit a more economical use of their time and to aid in making the school more broadly useful to the Corps of Engineers and to the Army at large.

The electrical laboratory is being fitted up from an allotment made by the Secretary of War.

A part of the work of the school has been in training selected men of the Third Battalion of Engineers in the various mechanical trades. Instruction was given, somewhat on the lines of the New York Trade School, in carpentry, blacksmithing, masonry, and plumbing under the direction of Captain Burr. Instruction in printing, telegraphy, and photography was under the direction of the adjutant, and that in mechanical and topographical drafting under the direction of Captain McKinstry. Instruction in care and management of steam plant is being given during the summer season with a steam launch and a steam road roller. Two details of one or two men were made from each company for each branch of instruction, and these details alternated weekly, so that the men should not lose too much of the regular company instruction. As the men became proficient or as individuals showed lack of aptitude or interest, new details were made.

The greater part of the trade-school work began in October, instruction in each branch being started as soon as facilities therefor were available. The photographic work could not be begun until March, it having been necessary to make structural changes in an old guardhouse to fit it for a laboratory.

Work in all branches excepting carpentry and photography was stopped on April 1, and instruction in carpentry on June 1. As stated above, instruction in the care and management of a steam plant was not begun until May, no plant having been available. It is expected, with funds now available, to provide during the coming year increased instruction in this branch and also instruction in the simpler forms of machine-shop work. The following statement gives a synopsis of the work done:

Carpentry.—Sawing, hand and crosscut; planing; mitering; rabbetting; framing, including house and bridge work. Number of men instructed, 20.

Blacksmithing.—Welding; tempering; forging; filing; draw filing; threading and making bolts; tool making. Number of men instructed, 8.

Masonry.—Mixing mortar and concrete; building brick walls and piers; laying brick floors. Number of men instructed, 10.

Plumbing.—Soldering; wiping joints; setting up plumbing fixtures, with special reference to sanitary arrangement of same; tapping mains. Number of men instructed, 8.

Mechanical and topographical drawing.—Geometrical construction; elevation and perspective; conventional signs; reconnaissance and plotting from notes; general practice in tracing. Number of men instructed, 9.

Printing.—Setting and distributing type; setting up work; use of press. Number of men instructed, 10.

Telegraphy.—Setting up and wiring instruments; sending and receiving by ear. Number of men instructed, 8.

Photography.—Exposing, developing, fixing, intensifying, and reducing dry plates and films; printing on madura, blue, solio, and velox papers; toning, fixing, mounting, and burnishing prints; making all solutions; sensitizing blue-print paper; copying and enlarging. Number of men instructed, 23.

Steam plant.—Management of steam launch and steam road roller. Number of men instructed, 6.

The object of the trade-school instruction is two fold. It is desired so to instruct the companies of the battalion that there will be men in each competent to perform any class of work which may be required in exposed situations during active operations of an army in the field, when civilian labor is not available. The second object is to give as wide a training to the men as practicable, so as to develop to the fullest extent individual intelligence. Incidentally, such mechanical training is appreciated by the soldier. In so far as it has been tested, the system has worked well, and it is believed that the introduction of at least a part of this training in the other branches of the service would be advantageous. It is noted that action on these lines has recently been taken by Norway and Sweden.

ENGINEER FIELD MANUAL.

Chapter I, "Topographical Reconnaissance" was completed, as stated in the last report. A small edition was printed and circulated for criticism. Work on the remaining parts was suspended during the organization of the Third Battalion and the removal to Washington Barracks.

On November 7 Capt. W. V. Judson, Corps of Engineers, was placed in charge of the work, in addition to his other duties. Captain Judson thoroughly revised Part II, "Military Bridges," and added much new matter. This part is now practically ready for the printer. The chapters on "Military roads" and "Military railroads" are now in course of preparation by Captain Judson. On May 31 Capts. Edward Burr and Charles H. McKinstry, in addition to their other duties, were directed to prepare the chapters on "Demolitions" and "Camping, sanitation, and water supply," respectively. Both chapters are under way. The work has been much retarded by the lack of proper clerical assistance, which could not be obtained on account of absence of funds for the purpose, and by the other duties of the officers.

During the past year an instrument has been devised at the school for reconnaissance work, with the object of meeting certain objections found to the use of the "Batson board," a patented article, and to the cavalry sketching case. The instrument is called a "hand plane table," and was manufactured by Keuffel & Esser, who cooperated most cordially in working out the plans. This instrument has been partially tested here, and with certain very minor changes promises to be satisfactory.

Much consideration has been given to the subject of intrenching tools, and a Board of officers, composed of the company commanders of the Third Battalion, has made tests of several devices, some of which give promise of good results.

Two forms of trestles, designed to take the place of the unsatisfactory service trestle of the ponton train, have also been tested, with

good results. One was made on designs of Captain McKinstry and one on designs of Sergeant Cudworth and Private Schenk, of Company M.

III.—THE THIRD BATTALION OF ENGINEERS.

When the Second Battalion of Engineers departed for the Philippines on June 17, 1901, a detachment of 45 men of the original battalion was left from which to form the three companies of the Third Battalion, which were to be stationed at Willetts Point. Of this number 7 were on detached service and 4 on furlough. On account of this small command details for routine work were reduced to the minimum, and to this end all the men present were provisionally formed into Company I, with the intention of dividing into three companies as soon as the enlisted strength should exceed 90 men. Companies K and L were formed into skeleton companies, composed of the officers assigned to those companies per General Orders, No. 22, Adjutant-General's Office, February 26, 1901, and of the enlisted men absent on detached service. On July 17 the strength having increased to the desired amount, Companies K and L were expanded by the transfer of men from Company I. Recruiting for the battalion was carried on throughout the country, special recruiting being carried on by three officers of the battalion per authority of Special Orders, No. 150, Adjutant-General's Office, Lieutenant Smith, stationed at Detroit, Mich., Lieutenant Jackson in northern Maine, and Lieutenant Jewett at Buffalo, N. Y. By the end of August the average strength per company was 75 men, which was increased to 95 men during September. During July, August, and September the regular guard and police duties were carried on; the companies were instructed in infantry drill, school of the pontoneer, construction of ponton, spar, and trestle bridges, and details from the different companies received instruction in telegraphy, plumbing, blacksmithing, carpentry, masonry, and operation of electrical and marine engines.

Details of noncommissioned officers and selected privates also received instruction in reconnaisance.

On September 6, 1901, General Orders, No. 117, Adjutant-General's Office, directing the Third Battalion of Engineers and the Engineer School of Application to proceed to and take station at Washington Barracks, D. C., was received. The following report of change of station was submitted by me on October 25, 1901:

On September 6, 1901, the following order was received:

GENERAL ORDERS, No. 117.

HEADQUARTERS OF THE ARMY,
ADJUTANT-GENERAL'S OFFICE,
Washington, September 3, 1901.

By direction of the Secretary of War the United States Engineer School at Willets Point, N. Y., will be removed to and established at Washington Barracks, D. C.

The engineer troops on duty at Fort Totten, Willets Point, N. Y., will proceed to stations as follows: Company A, First Battalion, to Fort Leavenworth, Kans.; the band and Companies I, K, and L, Third Battalion, to Washington Barracks, D. C.

The staff of the school and student officers will proceed to Washington Barracks, D. C., the travel enjoined being necessary for the public service.

The Fourth Battery, Field Artillery, will be relieved from duty at Washington Barracks, D. C., and will proceed to Fort Myer, Va., and take station.

The Quartermaster's Department will furnish the necessary transportation, the Subsistence Department suitable rations, and the Medical Department the proper medical attendance and supplies.

By command of LIEUTENANT-GENERAL MILES:

THOMAS WARD,
Acting Adjutant-General.

In order to enable the requirements of this order to be carried out as expeditiously as possible, the morning drills of the Third Battalion of Engineers, except recruit drills, were discontinued on September 8, and all available men were ordered to attend fatigue calls daily, and were engaged in packing and preparing for shipment the tools and material and other property pertaining to the Engineer School and the Third Battalion of Engineers. The supervision of the preparation and packing of the property was divided as follows:

Capt. Francis R. Shunk, Corps of Engineers, was put in charge of the preparation of such torpedo and electrical supplies as were to be transferred to the artillery and such electrical supplies as were to be shipped to Washington Barracks.

Capt. James F. McIndoe, Corps of Engineers, was put in charge of the preparation of lists and the packing of material needed for the general instruction of the engineer battalion and material needed for the departments of civil and military engineering of the school.

First. Lieut. Thomas H. Jackson, Corps of Engineers, was placed in charge of the preparation for shipment of the library and museum of the Engineer School.

First Lieut. W. P. Wooten took charge of the packing of photographic laboratory and printing office.

First Lieut. William D. Connor, Corps of Engineers, was relieved from duty as quartermaster of the post of Fort Totten, and in compliance with Special Orders, No. 208, Adjutant-General's Office, left the post on September 19 to proceed to Washington Barracks to receipt for quartermaster property. On September 24 a detachment of 3 noncommissioned officers and 24 privates of the Third Battalion of Engineers proceeded from Fort Totten to Washington Barracks to report to Lieutenant Connor and assist in taking charge of the post in advance of the arrival of the Third Battalion.

On September 26, in order that the work of packing might be expedited as much as possible, the afternoon infantry drills were discontinued and additional time was obtained for the work. Information was received from the depot quartermaster in New York on September 29 that the freight and baggage pertaining to the school and troops would be sent by water transportation on October 8. Captain McIndoe was then placed in general charge of the packing, hauling, and preparation for shipment of the freight to be transferred and was assisted by Lieutenants Jackson, Poole, and Jewett and later by Lieutenant Rhett. On the afternoon of Friday, October 4, two lighters of the Old Dominion Steamship Company arrived at Willets Point, and loading the freight, most of which had been previously hauled to the wharves, was begun. On Saturday the Old Dominion steamship *Guyandotte*, which had been hired by the Quartermaster's Department to transport the troops and freight, arrived and anchored in deep water several hundred yards from the wharves. The transfer of freight from the lighters was then begun and on Monday was completed. Until Monday noon it had been intended to embark the troops Tuesday morning, as it was expected that the ship would sail about 10 or 11 o'clock a. m., but it was then learned that in order to reach the mouth of the Potomac at a time when the conditions for the passage up the river would be most favorable it would be necessary to sail at about 6 o'clock Tuesday morning, and it was determined to embark the troops that night. Although some of the men had been granted passes until reveille next morning, notification of the change in time reached them and the embarkation was effected at 8 p. m. with no absentees.

Credit is due the officers and men of the battalion for the faithful and efficient performance of the duties assigned them, and particularly to Captain McIndoe and his assistants for the prompt transfer of the materials to the wharves, to the lighters, and thence to the ship, where it was stored by stevedores hired by the Old Dominion Steamship Company.

The arrangements on the ship and the courtesy of the representatives of the Old Dominion Company, including the captain and officers of the *Guyandotte*, made the trip to Washington a most enjoyable one.

On arrival at Washington the ship was unloaded by contract made by the depot quartermaster at Washington and the material piled near the wharf.

The distribution of the packages to the various storehouses, barracks, and quarters was made quickly and efficiently by the labor of the troops, under the direction of the battalion quartermaster, Lieutenant Connor, with the transportation belonging to the post and extra wagons furnished by the contractor.

Drills were resumed October 14. Until December 24 Company M, the fourth company of the battalion, was stationed at West Point, N. Y. Its duties were to assist in the instruction of cadets in practical military engineering and to furnish details for guard and teachers for the post school. In addition to this the company was instructed in infantry drill, target practice, and various engineering drills. Several practice marches were held. In compliance with General Orders, No. 161, Adjutant-General's Office, Company M was ordered to proceed to and take station at Washington Barracks, D. C. The company left West Point December 24, and arrived at Washingtod Barracks December 25, 1901.

In accordance with General Orders, No. 34, Adjutant-General's Office, the strength of the companies of the First and Third battalions of engineers was reduced from 104 to 93 men, the remaining 11 men in each company to be consolidated into an engineer detachment to be stationed at West Point.

This reduction was effected by the transfer of 3 sergeants and 1 second-class private from the Third Battalion. The allowable strength of the companies at Washington Barracks in accordance with this order is 9 sergeants, 9 corporals, 35 first-class privates, 36 second-class privates, 2 cooks, and 2 field musicians.

The course of instruction of the battalion as approved by the Chief of Engineers was as follows:

Until March 31:

1. Practice marches (discontinued December 21).
2. Knots; lashings; splicing; blocks and tackles; moving heavy weights; erection of derricks, shears, and gins; signaling.
3. Manual of arms; gymnastics; wall scaling; fire drill; bayonet exercise; military calisthenics.

The companies alternated daily in the three classes above mentioned, except practice marches, which, due to the weather, were discontinued after December 20. Before discontinuance, however, each company stationed at Washington Barracks had made eight practice marches, varying from 6 to 25 miles. The maximum march was 25 miles in heavy marching order, knapsacks being carried. In addition, instruction was given in trade-school work, as previously reported.

From December to March, inclusive, the company commanders gave instruction daily to the noncommissioned officers and selected privates in drill regulations, manual of guard duty, firing regulations, troops in campaign, field fortifications, military bridges, reconnaissance, and use of surveying instruments.

Post school for enlisted men was held from December 20 to March 31, instruction being given in the following branches: Arithmetic, mensuration, algebra, geometry, trigonometry, use of surveying instru-

ments. The attendance at the post school was voluntary, the average daily attendance being about 25.

The companies were instructed for one hour each week in the duties of litter bearers and the methods of rendering first aid to the sick and wounded.

Beginning April 1, the summer course of instruction was as follows:

April: Infantry drill in school of company and battalion, from 7 to 8 a. m. Engineer drill from 9.30 to 11.30 a. m., to include bridges, with advance and reserve pontoon train, trestles, cask bridges, railroad-track construction, etc.

May: Physical exercise drills, running, jumping, rope climbing, wall scaling, etc., daily from 7 to 8 a. m. Engineer drill as for month of April.

June: Engineer drill from 8.45 to 11.30, as above. Beginning June 19, one company went to Fort Foote each day in order to clear ground for a target range to be used during the coming season. A garden for the benefit of the troops was begun at Fort Foote in April, the work being done by a detail of one noncommissioned officer and eight privates, this detail being changed each ten days.

When the troops arrived at the post in October the finances of the post exchange were in a very poor condition, due mainly to the very small garrison and to the many changes which had taken place within the past year. The work of restocking the exchange was at once begun, and, due to a great extent to the efforts of First Lieutenant Jackson, who was in charge of the post exchange until May 1, it is now on a firm basis.

During the year the battalion has taken part in the following ceremonies:

Funeral ceremonies of President McKinley, September 17, one company. Funeral ceremonies of General Ludlow, September 3. Review and inspection by the Assistant Secretary of War, the Adjutant-General of the Army, and the Chief of Engineers, November 22. Reception of Prince Henry of Prussia, February 24. Funeral ceremonies of General Stanley, March 17. Funeral ceremonies of General Rosecrans, May 17. Unveiling of monument to soldiers and sailors who died during the war with Spain, May 21. Unveiling monument to Marshal Rochambeau, with review of troops by the President of the United States, May 24. Funeral ceremonies of British ambassador, Lord Pauncefote, May 28. Review and inspection by the Chief of Engineers, June 6, 1902.

The battalion and post were inspected by Maj. J. D. C. Hoskins, assistant to the inspector-general, Department of the East, on April 23 and 24.

Special details from the battalion during the past year have been as follows:

Two noncommissioned officers and 2 privates on duty connected with road making in Alaska until February, 1902; 1 sergeant on duty at Fort Rodman, Mass., in connection with transfer of submarine-mining material, absent until August 9; 1 sergeant on recruiting duty from July 6 to August 17; 1 sergeant at Willets Point, N. Y., in connection with the engineer depot, from October 7 until April 14, 1902; 2 sergeants and 3 privates at West Point, N. Y., retained as school teachers and in connection with post water supply from December 24 to January 17, 1902; 1 officer and 12 enlisted men as a special guard of honor for Prince Henry of Prussia during his stay in Washington in February; 2 sergeants on duty in Charleston, S. C., in connection with exposition from March 11 to June 20; 1 corporal on recruiting duty from May 13 to May 18; 1 private on duty connected with the Board of Ordnance and Fortification, left post June 3, still absent; 2 sergeants on duty in connection with exposition in Rhode Island, left the post on June 25, are still absent.

Before beginning the winter drills in calisthenics, etc., a set of physical measurements of the men in the four companies was taken, a corresponding set being taken after the completion of these drills. As the majority of the men in the battalion were in their first year of service, a comparison of the two sets of figures gives a good idea of the benefit derived from these exercises. An increase was shown in all measurements, the following being some of the most important:

Weight, average increase per man of about 2½ pounds.
Chest measurement, expiration, $\frac{9}{10}$ inch.
Chest measurement, inspiration, $1\frac{3}{10}$ inches.
Amount of expansion, $\frac{4}{10}$ inch.

In his report on these measurements the post surgeon says:

Correlative with this physical improvement shown by the tape is an even greater one in the morale of the command. It is noticeable that despite the facts that this command is made up in great part of recruits, and that it is stationed where it is fully exposed to the debauching influences of a large city, only 4 per cent of the command is on sick report. Cases of venereal diseases or of serious illness are extremely rare. Not the least part of the profit derived from the winter's work are the erect carriage, bright eyes, clean skin, and alert, vigorous manner which now characterize the members of this command, indicating their excellent general health.

In addition to the regular course of instruction the following has been accomplished:

All material packed at Willets Point and unpacked at Washington Barracks; museum property and miscellaneous property belonging to the school properly stored and cared for; the printing outfit has been set up in the basement of headquarters building and is now in working order; the photographic outfit has been arranged in the new photographic laboratory; the library has been partially unpacked and arranged. A departure in the arrangement of the books has been made in that scientific books and periodicals relating to the various departments of instruction are sent direct to the offices of these departments.

The instructors of the different departments have been installed in offices assigned to them in the building set aside as an academic building. This building was formerly used as a double set of officers' quarters, but has been altered as the needs of the school demanded.

A small frame building has been erected as an astronomical observatory, and a transit and a zenith telescope installed.

The enlisted men of the battalion have also been called on to handle the material of the Engineer Depot which has been shipped from Willets Point, amounting in all to about 1,000,000 pounds.

Officers of the Corps of Engineers were on duty with the Third Battalion of Engineers as follows:

Maj. W. M. Black, commanding the battalion.
First Lieut. W. P. Wooten, adjutant until November 18, 1901.
First Lieut. F. C. Boggs, adjutant since November 18, 1901.
First Lieut. W. D. Connor, quartermaster and commissary.

COMPANY I.

Capt. F. R. Shunk, relieved May 1, 1902.
First Lieut. H. W. Stickle, joined July 9, 1901; transferred to Company A, First Battalion of Engineers, September 21, 1901.
First Lieut. T. H. Jackson, transferred from Company K, August 22, 1901.
First Lieut. A. B. Putnam, joined March 18, 1902.
Second Lieut. J. H. Poole, transferred from Company L, April 4, 1902.

COMPANY K.

Capt. C. H. McKinstry, relieved October 19, 1901.
Capt. C. W. Kutz, joined November 2, 1901.
First Lieut. F. C. Boggs, relieved and appointed adjutant November 18, 1901.
First Lieut. W. P. Wooten, joined November 18, 1901; relieved May 1, 1902.
First Lieut. T. H. Jackson, transferred to Company I August 22, 1901.
First Lieut. A. E. Waldron, joined March 13, 1902.
Second Lieut. H. C. Jewett.

COMPANY L.

Capt. J. F. McIndoe.
First Lieut. C. S. Smith, relieved September 19, 1901.
First Lieut. E. M. Rhett, joined October 3, 1901.
First Lieut. M. J. McDonough, joined March 19, 1902.
Second Lieut. J. H. Poole, transferred from Company L, April 4, 1902.

COMPANY M.

Capt. J. E. Kuhn, relieved December 12, 1901.
First Lieut. M. L. Walker, joined January 27, 1902.
First Lieut. W. B. Ladue, relieved December 12, 1901.
First Lieut. Harry Burgess, temporary command, joined December 25, 1901; relieved January 1, 1902.
First Lieut. E. M. Adams, joined December 15, 1901.
First Lieut. W. P. Stokey, joined March 24, 1902.

IV.—ENGINEER DEPOT.

1. Public Buildings, Boats, Constructions, etc.

On departure of the Third Battalion of Engineers and the Engineer School, in October, 1901, the Engineer Depot with ponton and bridge equipage, stores for bridge and ponton trains, surveying instruments, reconnaissance materials, submarine-mining materials and necessary appliances, general stores and tools for current use and repairs to buildings and machinery, steamboats and all machinery were left at Willets Point, N. Y.

A limited supply of general tools, materials, intrenching tools, and stationery for probable use of the Engineer School, the Battalion of Engineers, and for establishing a small depot at Washington Barracks, authorized by the Chief of Engineers, United States Army, were transferred to Washington Barracks at the time of the removal of the school and the battalion.

Of other property which pertained to the Engineer School and had been used for the instruction of engineer troops in their special duties and cared for by the Engineer Depot at Willets Point, N. Y., the following were taken by the battalion to Washington Barracks, D. C., viz:

a. The entire outfit of the photographic laboratory, including the lithographic apparatus.
b. The astronomical outfit used at Willets Point in astronomical instruction.
c. The engineer museum property.
d. One division of advance guard and one division of reserve ponton train equipage.
e. A supply of intrenching tools, materials, etc., for use of the Third Battalion of Engineers.
f. One railroad-track outfit, consisting of 1,410 feet of steel rails, plates, bolts, spikes, ties, and switches.
g. Miscellaneous tools and materials forming the outfit for the trade school.
h. A supply of stationery and drawing materials, including office desks and chairs.
i. The entire printing and bookbinding outfit.
j. A few electrical testing instruments not used in the electrical laboratory.
k. The reconnaissance outfit authorized for battalion headquarters.

No proper store buildings for the depot property were found at this post, and the property had to be placed in the gun shed, stables, magazines, and basement of one of the barracks. It is under shelter and is stored by classes as far as practicable, but it is not secured against fire and theft, nor can it be so cared for as to prevent deterioration with the existing facilities.

Incidental repairs to buildings used for depot and instruction purposes have been made on various occasions.

A small naphtha launch was received here during the month of January from the works at Pensacola, Fla. The boat needs repairs, which will be undertaken when funds from the new appropriation for the fiscal year 1903 become available.

2. Work of the Depot.

The property and buildings were cared for by enlisted men of the engineer battalion detailed on special duty and receiving extra-duty compensation for their services.

Property taken from the Engineer Depot at Willets Point, N. Y., for the use of the school and the battalion, was unpacked and verified on arrival here and properly arranged according to the different classes. All ponton materials and intrenching tools were stored in one building, formerly used as a gun shed.

The engineer-museum property is temporarily stored in an unoccupied stable building until proper rooms for the reception of this property can be provided for. The work of unpacking and checking up this property required considerable time and labor of the depot and office employees.

The printing plant brought here was placed in the basement of the administration building. Some slight repairs were made to the printing machinery, and by the end of December the printing plant was properly arranged and the usual work was begun.

The office property and records of the school and depot were placed in a room on the ground floor of the administration building, which was fitted out with the most needed office furniture, shelves, and tables.

The photographic plant on arrival here was temporarily placed in a room in the basement of the administration building, and such work as could be carried on with the limited space available was done. During the month of February the plant was removed to a building, formerly used as guardhouse, which was modified to meet the requirements necessary in photographic work and instruction.

Delivery of professional periodicals for library of the Engineer School of Application has continued. Subscriptions for these have been renewed from January 1, 1902, for the current year. Sixty-four professional works of recent date, treating of civil, military, and electrical engineering, were added to the library during the year by purchase. The various periodicals in the library received during the past two years have been assembled and verified as to their completeness, arranged according to volumes, and 165 volumes have been thus assembled; 116 volumes were bound in this city at a total cost of $112.50. The remaining volumes will be bound when funds from new appropriations become available.

Considerable time and labor were consumed in unpacking and assorting all the professional books brought here from Willets Point.

Purchases under proposals were made during the year of various materials needed for current use of the depot, school, and instruction of engineer troops in their special duties. Among the more important purchases the following are mentioned, viz:

One large fireproof and burglar-proof safe for securing records and drawings of the Engineer School, placed in the academic building; 1 large fireproof and burglar-proof office safe, for current use of depot and school office; 3 Oliver standard typewriting machines; 12 office tables; 24 office chairs; 26,000 feet B. M. assorted lumber.

Owing to the small balance of funds available for the use of the depot and school, the greatest economy had to be exercised in order to carry on the work to the end of the fiscal year, and a great number of intended and needed purchases were postponed until funds for fiscal year 1903 become available. Numerous purchases were made during the year of stationery to fit out depot and school office, offices of the instructors, and instruction rooms. There were also numerous purchases of photographic materials, hardware, etc., which were needed to continue the instruction courses, and expenditures for labor. All the funds for the school and depot were expended on June 30, 1902, except $1.66, which will be turned into the Treasury.

The eight wooden ponton boats brought from Willets Point, N. Y., were calked and painted.

On February, 1902, information was received that it was intended to abandon the Engineer Depot at Willets Point, N. Y., and shipments of depot property from Willets Point were received here from time to time to the close of the fiscal year.

Considerable work attended the receiving, checking up, and storing the great bulk of this property, coming as it did in about 50 different shipments, ranging from 5,000 to 35,000 pounds. It may be roughly estimated that the total weight of all the shipments received exceeds 1,000,000 pounds. Additional storage room had to be provided in various buildings on this post, and even some of the basements of the company quarters had to be taken for the storage of this property.

The property received consisted of various surveying, astronomical and reconnaissance instruments, miscellaneous tools, intrenching tools, machinery, material, etc. The greater portion of this property is in fair condition, but requires more or less repairs, overhauling, and cleaning.

In addition to this a large lot of engineering materials was received here in May from the discontinued Department of Cuba, consisting of surveying instruments, photographic materials, and a few intrenching tools. This is in fair condition, but needs overhauling, cleaning, and repairing before being fit for issue.

Under the requirements of circular No. 13, Office of the Chief of Engineers, dated June 7, 1902, shipment of various small lots of instruments were received in the depot. Those received up to this date are of such antiquated patterns that it is rather doubtful whether they will give satisfaction when issued for use on any of the public works.

A number of unserviceable articles of the depot property were inspected and condemned in April. Among the articles so condemned were 166 short chess, pertaining to the one division of advance guard ponton equipage brought here with the battalion in October, 1901. Attempts have been made to replace these by purchase.

Proposals were invited and opened in May. No bid was received on clear white-pine chess, and only one bid was received for the furnishing completed chess of poplar. The bid was accepted and the chess was delivered here before the close of the fiscal year. Proposals were also invited for 7 long and 7 short balk, of poplar, for experimental use; one bid was received and accepted, but owing to delay in transportation delivery has not yet been made. It is evident that other material than clear white pine will have to be adopted for the ponton trains. From all information obtained here and before removal from Willets Point, N. Y., clear white pine lumber of the grade required for ponton and bridge materials is not to be had any longer in the markets of the United States. Investigations on the lines of suitable materials for ponton equipage will be continued.

The depot force was continuously engaged in caring for the property pertaining to the school and the battalion, making needed repairs, and making issue for instruction purposes when required.

Minor repairs to instruments needed for issue and instruction purposes have been made in the depot by enlisted men. Larger instruments, such as transits, levels, theodolites, magnetometers, field glasses, etc., needed to fill requisition, have been sent to repair shops in this city.

During the month of June work was commenced in overhauling and repairing electrical instruments and machinery for the use of the department of electrics, and in fitting up electrical laboratory. Specifications and forms of proposals were prepared for the plant and electrical instruments to be bought under the allotment of $6,300 made by the Secretary of War for this purpose.

A small frame building was erected by the post quartermaster in close proximity to the academic building, to serve as an astronomical observatory. The necessary interior arrangements, such as shelves and tables, lights, etc., were fitted up, the astronomical outfit of instruments was removed from the depot storehouse, and instruments were overhauled, cleaned, and repaired and set up.

Numerous requisitions for instruments, reconnaissance materials, drawing instruments, intrenching tools, materials, etc., duly approved by the Chief of Engineers, United States Army, were referred to this office, and all materials asked for were shipped to destination with as much promptness as the nature of the property to be transferred would admit. Delays were caused by the necessity for overhauling and repairing.

A number of requisitions have not been filled owing to the fact that no funds were available for the purchase of the articles requested.

During the period from the establishment of the depot at this post to the end of the fiscal year the following instruments and other material pertaining to the Engineer Depot have been issued to engineer officers and acting engineer officers at department headquarters

and to officers of the Corps of Engineers engaged on public works and surveys, viz:

6 transits, engineers'.
9 levels, engineers'.
1 theodolite.
6 level rods.
40 cavalry sketching cases.
28 compasses, pocket, assorted.
11 compasses, prismatic.
2 clinometers.
6 barometers, aneroid.
1 barometer, mercurial.
7 drawing boards.
2 pocket sextants.
52 triangles, assorted.
4 rulers, rubber.
1 steel tape, 100 feet.
9 scales, boxwood, triangular.
4 proportional dividers.
19 protractors, Abbot's.
1 protractor, german silver.
4 T-squares.
8 sets drawing instruments.
12 ink cups.
12 field glasses, binocular.
18 hand levels, reflecting.
6 pedometers.
1 passometer.
5 odometers.
2 ink slabs.
4 500-foot rolls paper, 13 inches wide.
5 yards tracing linen.
5 yards cross-section paper.
12 dozen pencils, assorted.

In addition to the foregoing articles, requisitions for the following instruments were delayed pending repairs, viz:

2 theodolite magnetometers.
14 metric scales, United States Lake Survey.
1 beam compass.
4 field glasses, binocular.
1 current meter.
1 chronograph.

Six engineers' transits and 2 engineers' levels needing repairs were sent for repairs to the subdepot at New York, N. Y.

3. Equipment of Engineer Troops.

On the removal of the school and battalion from Willets Point to Washington Barracks, D. C., all balances of funds from appropriation for equipment of engineer troops remained with the depot at Willets Point, N. Y.

The three companies of the Third Battalion before leaving Willets Point were supplied with an outfit of surveying and reconnaissance instruments and materials, drawing material, intrenching tools, carpenters', plumbers', blasting, and stone masons' tools, and one typewriting machine, all in accordance with the approved list of materials and tools referred to in last Annual Report.

Company M, stationed at that time at West Point, N. Y., was supplied with a similar outfit.

Under date of November 29, 1901, an allotment of $2,000 was made by the Chief of Engineers from the appropriation for "Equipment of Engineer Troops, 1902," for the purchase of instruments, reconnaissance materials, intrenching tools, etc., needed for experimental and school use and for filling requisitions for such materials as may be made by engineer officers serving in the field.

Under this allotment various purchases have been made of experimental instruments and tools; of instruments and materials to fill requisitions duly authorized by the Chief of Engineers, U. S. Army, and of ponton materials needed to replace worn-out and unserviceable materials.

A sample sketching case (hand plane table), made by the Keuffel & Esser Company on designs given by officers serving with the Engineer School, was submitted for trial and suggestion as to further improve-

ments. Several changes in the design were made, without expense to the United States, and when finally completed twelve were purchased under authority of the Chief of Engineers. For use with this hand plane table six Jacob's staffs were purchased. They were completed and delivered here during the month of March. In order that these plane tables may be subject to trial and criticism by officers at distant stations, four of them with two staffs were sent to the Philippines and a like number was sent to the commanding officer of the First Battalion of Engineers at Fort Leavenworth, Kans. The remaining four with two staffs have been extensively used and tried at this school by the officers under instruction and also by the instructors themselves.

A prismatic compass with an improved dial and hinged cover was furnished by the Keuffel & Esser Company, of New York, N. Y., and was sent to the Philippines for trial, where it is believed that the climatic conditions offer the best test.

A number of hickory handles, required to complete the outfit of blacksmiths' tools of each company of the Third Battalion of Engineers, were procured and issued to the companies. Minor intrenching tools and materials that were needed to replace worn out and expended articles of the four companies stationed here have been procured and issued.

One typewriting machine was bought and shipped to Company B, First Battalion of Engineers. All the companies of the First and Third battalions are supplied with typewriting machines, except Companies C and D, and it is recommended that provisions be made to supply these companies with a typewriting machine each.

A supply of special small-sized shovels and pick mattocks was bought and issued for trial.

The following shipments were made to the end of the fiscal year of instruments, intrenching tools, etc., purchased from the appropriation for "Equipment of Engineer Troops, 1902," viz:

8 new pattern hand plane tables in leather cases.
4 Jacob's staffs for use with the above.
6 dozen assorted pencils.
1 pantagraph complete.
1 prismatic compass with improved dial.
1 typewriting machine.
50 small-sized pick mattocks.
6 small-sized shovels with iron grip handles.
48 round-point shovels cut down to small size.

The sum of $2,000, allotted from the appropriation for "Equipment of Engineer Troops, 1902," was economically expended and pledged, and but $1 remained unexpended at the close of the fiscal year.

4. Miscellaneous.

In addition to the foregoing works, the depot and the depot office was charged with the following works, viz:

a. Torpedo Manuals.—Twenty-nine Engineer Torpedo Manuals were received from the Chief of Engineers, U. S. Army, for use of the Engineer School at Washington Barracks, D. C., with instructions to be considered highly confidential. These manuals were constantly under the direct charge of the commanding officer of the school and depot.

b. Record of Torpedo Board.—Under instructions of February 20, 1902, the records of the Torpedo Board were overhauled, listed, and forwarded to the Chief of Engineers, U. S. Army, on March 11, 1902. The property of the Torpedo Board, consisting of some experimental jointing and cut-out boxes, was invoiced March 29, 1902, to the officer in charge of the School of Submarine Defense at Willets Point, N. Y.

c. Kriegspiel apparatus.—On March 18 one set of Kriegspiel apparatus, including peg board and text-book, were received here from the W. B. Clarke Company, of Boston, Mass., under instructions from Colonel Livermore.

d. Reports.—Various reports were rendered to the Chief of Engineers from time to time on the various subjects referred to the school.

A list of recommendations of changes in certain paragraphs of the Army Regulations, 1901, was prepared; also a list of proposed changes in the regulations for "Troops in campaign," and forwarded to the Chief of Engineers.

A report relating to duties, organization, and equipment of engineer troops, which was prepared after much and careful study by the instructor in the department of military engineering at this school, was forwarded to the Chief of Engineers, U. S. Army, on February 12, 1902.

With the limited clerical force—consisting of but one clerk, the funds available not permitting an increase—the work of the school and depot office was carried on with difficulty, and delays in the execution of the official work were unavoidable.

Statement of funds.

I. ENGINEER DEPOT AT WILLETTS POINT, N. Y.

Fiscal year 1901, for "Washington Barracks."

October 8, 1901, amount transferred to Washington Barracks, D. C.....	$138.34
June 30, 1902, amount expended to the end of fiscal year.....	138.34

II. ENGINEER DEPOT AT WILLETTS POINT, N. Y.

Fiscal year 1902, for "Washington Barracks."

From the sums appropriated by Congress for the fiscal year ending June 30, 1902, the following amounts were transferred October 8, 1901, for use at the new station of the Engineer School and the Engineer Depot at Washington Barracks, D. C., viz:

1. For incidental expenses of the depot (incidentals).....	$1,800.00
2. For purchase of materials for use of United States Engineer School and instruction of engineer troops, and for travel expenses of officers (materials)	1,451.46
3. For library of the United States Engineer School, for purchase and binding professional works of recent date treating of military and civil engineering (library)	456.98
	3,708.44

Of this there has been expended and pledged at Washington Barracks, D. C.:

	Expended.	Pledged.	Total.
1. For incidental expenses of depot (incidentals)	$1,660.63	$139.31	$1,799.94
2. For purchase of materials for use of United States Engineer School and for instruction of engineer troops and for travel expenses of officers (materials)	1,392.89	54.97	1,447.86
3. For library of the United States Engineer School, for purchase and binding of professional works of recent date treating of military and civil engineering (library)	371.48	85.50	456.98
Total	3,425.00	279.78	3,704.78
Balance unexpended, to be turned into the Treasury			3.66
Total transferred to Washington Barracks, D. C			3,708.44

III. TORPEDOES FOR HARBOR DEFENSE.

The following sums from the above appropriation were transferred October 8, 1901, for use of the United States Engineer School at Washington Barracks, D. C., viz:

1. Act March 3, 1899, for torpedo experiments	$1,000.00
2. Act March 1, 1901, for purchase of submarine mining materials, etc...	5,300.00
	6,300.00

Under a decision of the Comptroller of the Treasury, dated December 4, 1901, the Secretary of War was not authorized to expend the above funds for the purpose for which they were transferred, and the above sum of $6,300 was withdrawn by the Chief of Engineers, U. S. Army, December 31, 1901.

IV. EQUIPMENT OF ENGINEER TROOPS.

Fiscal year 1902.

Under date of November 29, 1901, the Chief of Engineers, U. S. Army, made an allotment of $2,000 for purchase of instruments, intrenching tools, etc., for use of the United States Engineer School of Application.

1. Act of March 2, 1901, for instruments, intrenching tools, etc	$2,000.00
June 30, 1902, amount expended during fiscal year	1,505.68
July 1, 1902, balance unexpended	494.32
July 1, 1902, outstanding liabilities	493.32
July 1, 1902, balance available to be turned into the Treasury	1.00

V. GUN AND MORTAR BATTERIES (ACT MAY 25, 1900).

Under date of December 26, 1901, the Chief of Engineers made an allotment of $300 from the above appropriation for purchase of office safes for Engineer School of Application, at Washington Barracks, D.C.

December 26, 1901, amount allotted		$300.00
June 30, 1902, amount expended during fiscal year	$282.50	
June 30, 1902, amount turned into the Treasury during fiscal year	17.50	
		300.00

VI. EMERGENCY FUND, WAR DEPARTMENT (ACT OF MARCH 3, 1899).

FOR EQUIPMENT OF ELECTRICAL LABORATORY AT ENGINEER SCHOOL, WASHINGTON BARRACKS.

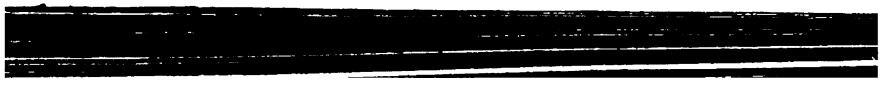
Under date of March 5, 1902, the sum of $6,300 from the above appropriation was allotted for the purpose of equipping an electrical laboratory at the Engineer School of Application at Washington Barracks, D. C.

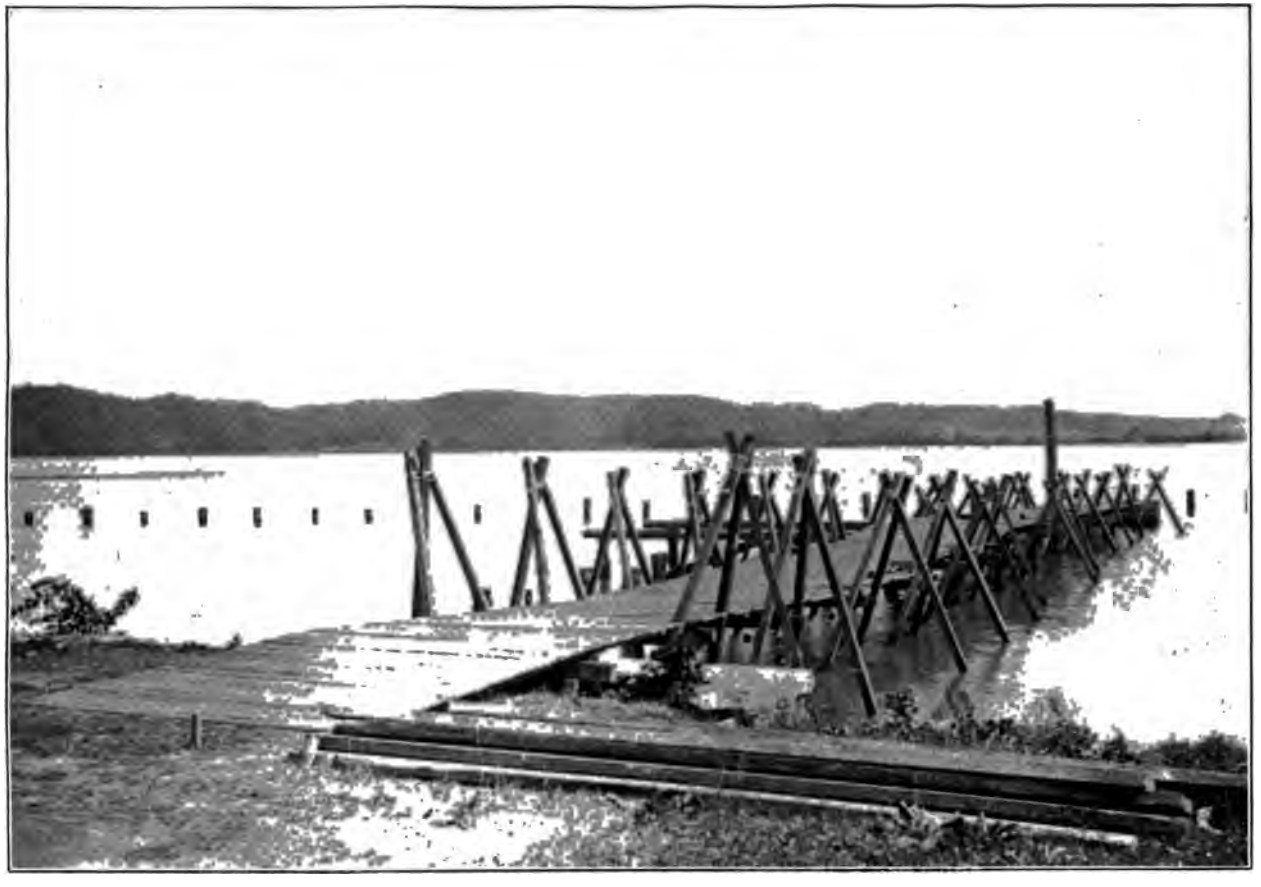
March 5, 1902, amount allotted	$6,300.00
June 30, 1902, amount expended during fiscal year	349.09
July 1, 1902, balance unexpended and available	5,950.91





CASK RAFT.

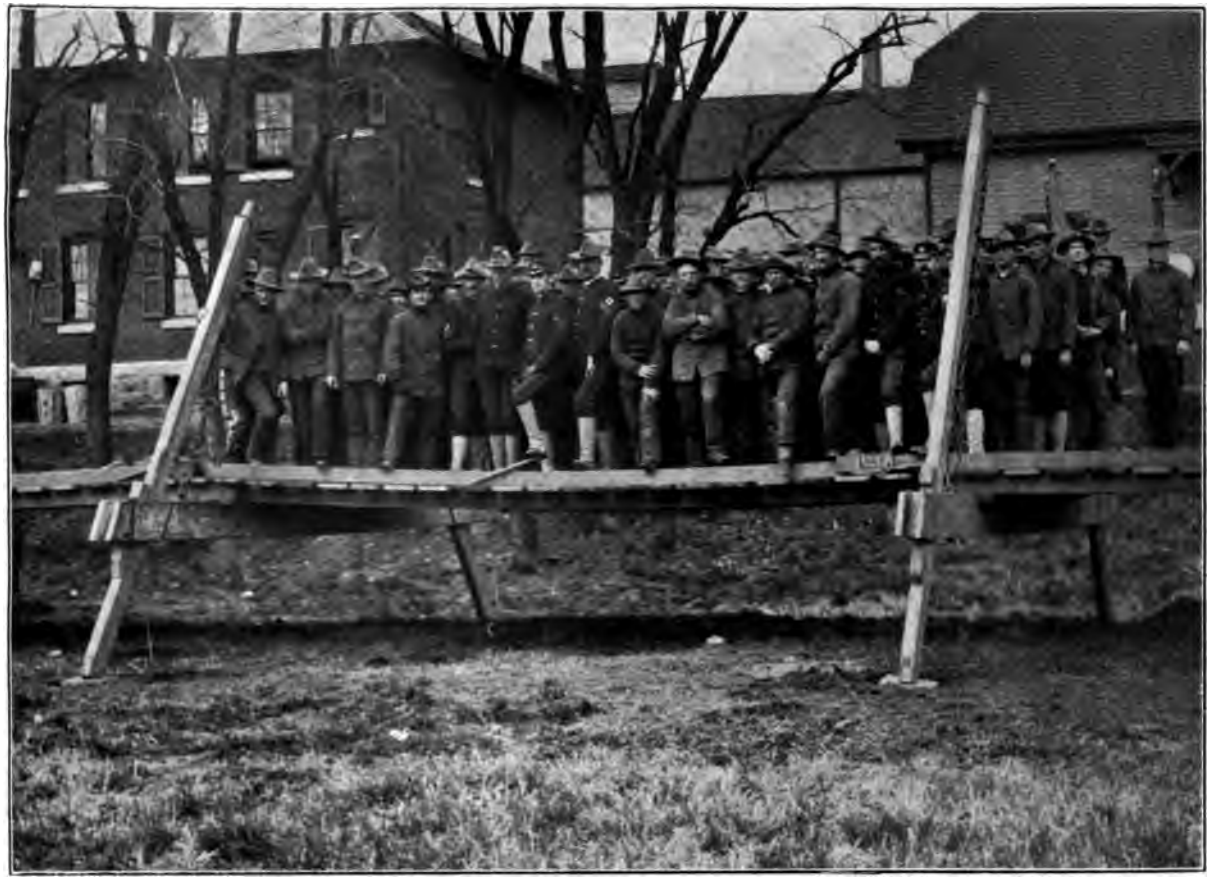




TRIPOD BRIDGE. FIRST HALF, LOW WATER: SECOND HALF, WATER ABOUT 6 FEET DEEP; 40 MEN, TIME TEN HOURS
TESTED WITH LOADED PONTON WAGON.

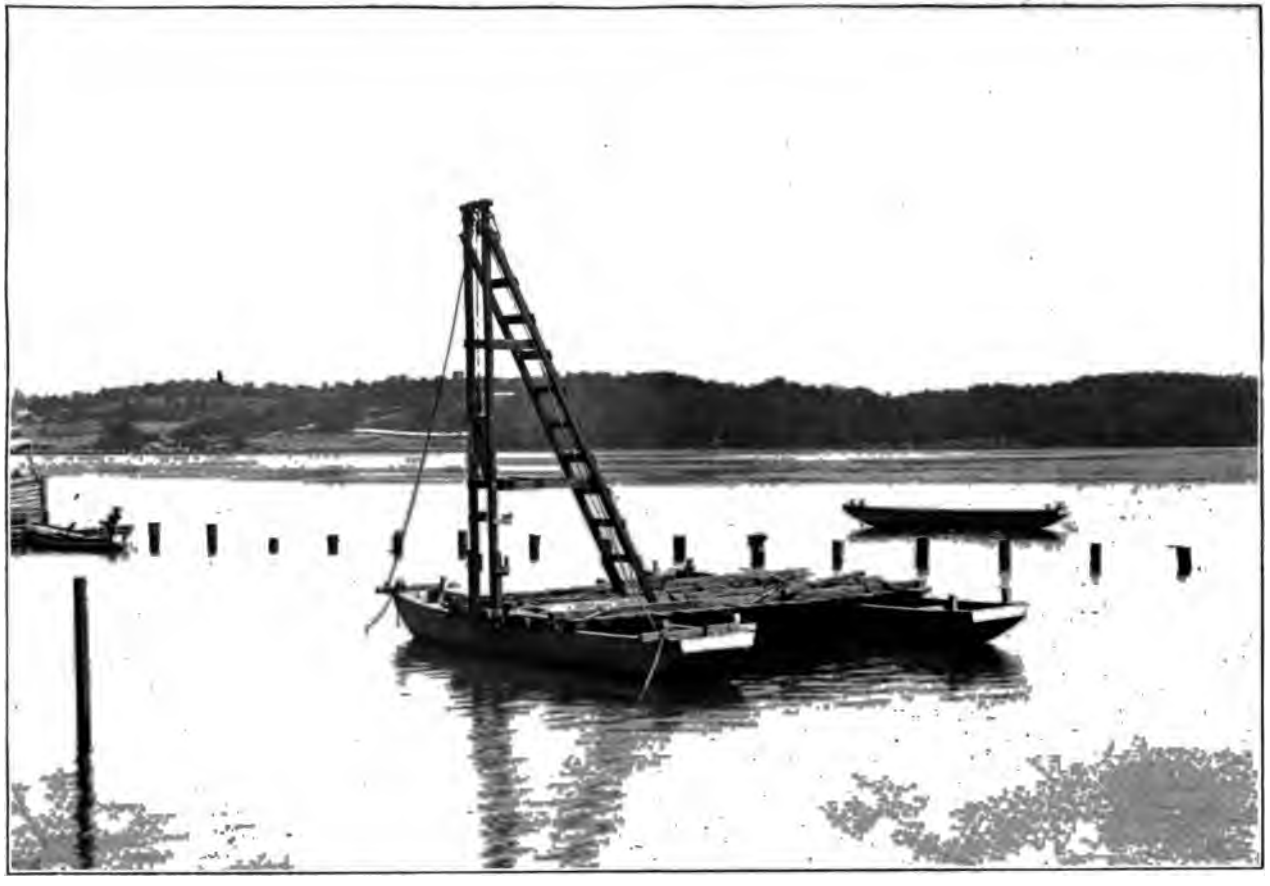




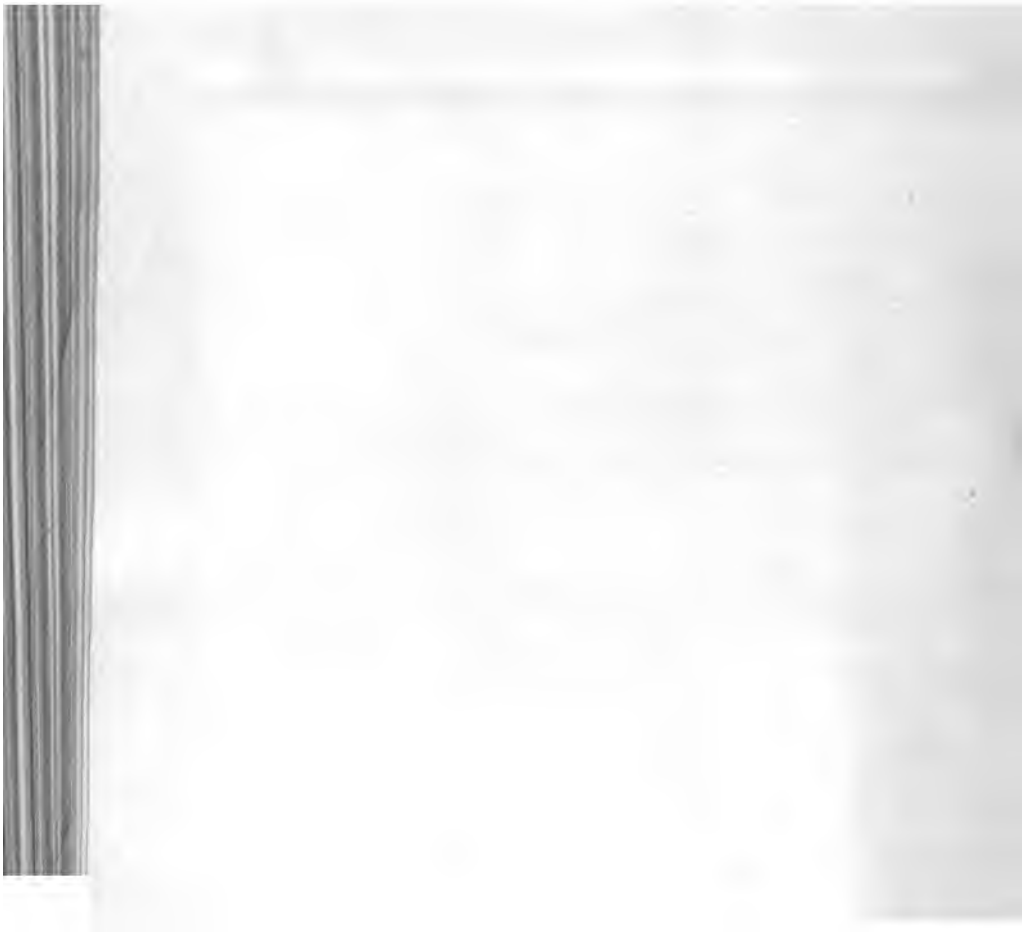


SERVICE (BIRAGO) TRESTLE BRIDGE LOADED WITH 52 MEN.



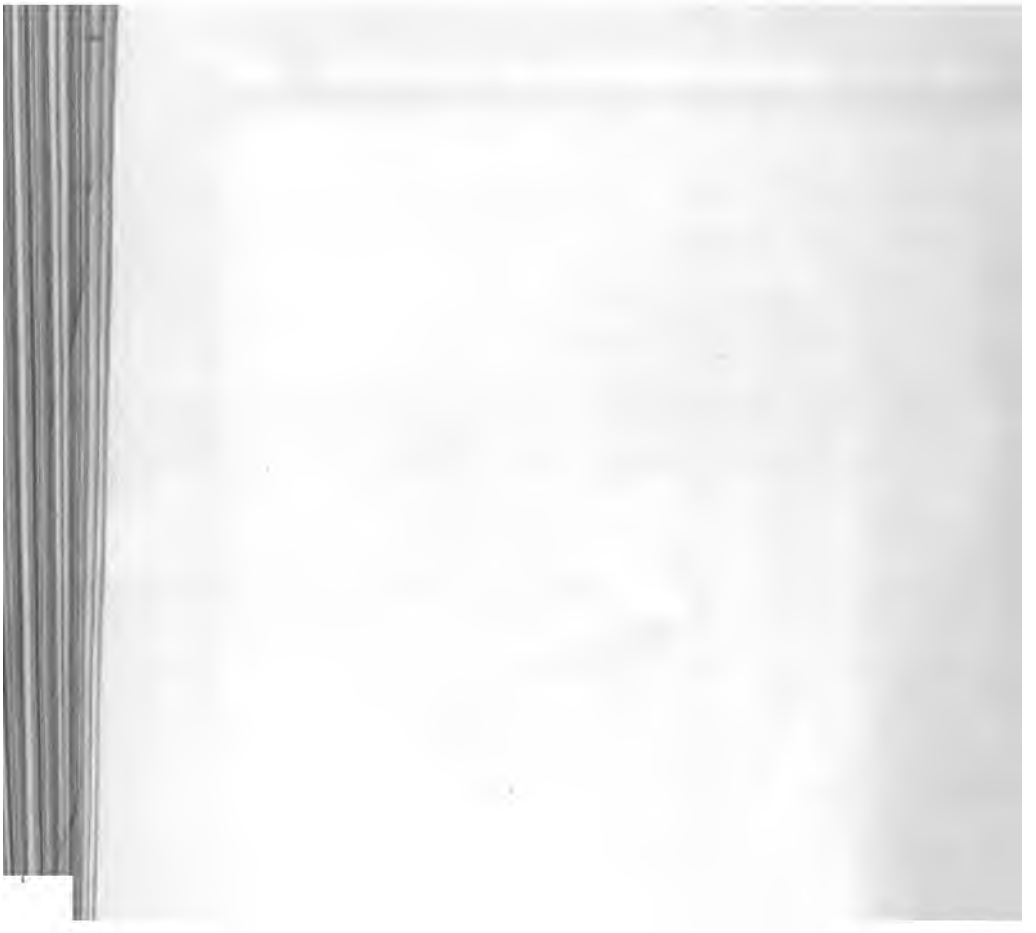


FLOATING PILE DRIVER IMPROVISED FROM RESERVE PONTON TRAIN USING SHORT BALKS. MODIFIED FORM DEVISED BY CAPTAIN KUTZ; 8 MEN, TIME SIX HOURS.





TRESTLE 60 FEET LONG, 20 FEET HIGH; 40 MEN, TIME SIX AND ONE-HALF HOURS.





RAILROAD WORK





TRESTLE ON RIGHT SHOWS McKINSTRY NOTCHES INSTEAD OF TOP NOTCHES.
TRESTLE ON LEFT SHOWS TRESTLE OF COMPANY M, THIRD BATTALION OF ENGINEERS.



APPENDIX No. 4.

ENGINEER DEPOT, WILLETS POINT, NEW YORK.

REPORT OF FIRST LIEUT. EDWARD H. SCHULZ, CORPS OF ENGINEERS, FOR THE FISCAL YEAR ENDING JUNE 30, 1902.

UNITED STATES ENGINEER OFFICE,
ROOM S–7, ARMY BUILDING,
New York City, July 17, 1902.

GENERAL: I have the honor to forward herewith, in duplicate, annual report of the United States Engineer Depot, Willets Point, N. Y., for the fiscal year ending June 30, 1902.

Very respectfully, your obedient servant,

EDWARD H. SCHULZ,
First Lieutenant, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

UNITED STATES ENGINEER DEPOT, WILLETS POINT, N. Y.

The depot has been under command of Maj. William M. Black, Corps of Engineers, from beginning of fiscal year to October 8, 1901; Capt. Charles H. McKinstry, Corps of Engineers, October 8 to November 6, 1901, and First Lieut. Edward H. Schulz, Corps of Engineers, November 6, 1901, to end of fiscal year. The office of the depot was moved on April 10, 1902, from Fort Totten, Willets Point, N. Y., to Army building, New York City. The depot was discontinued on June 30, 1902, at Fort Totten, Willets Point, and transferred to New York City.

Sergt. Charles M. Beer, Company C, First Battalion of Engineers, has been on extra duty as machinist in the Engineer Depot throughout the entire year, and has rendered efficient service.

1. PUBLIC BUILDINGS, CONSTRUCTIONS, ETC.

During the past year, and beginning about October 1, 1901, the entire material in the depot has been disposed of, by transfer and inspection and condemnation. All buildings used exclusively by the

Engineer Depot and School have been vacated and transferred to the artillery. These buildings included the officers' laboratory, the enlisted men's laboratory, the library building, the rooms of civil and military engineering departments, the observatory, the photographic building, the carpenter shop, the engineer stable, the torpedo sheds, the old fireproof building, the new fireproof building, the new instrument shop, the equipment shed, and the rooms of the United States Engineer Office. Minor repairs were made to above buildings and said buildings painted when so required.

2. WORK OF THE DEPOT.

The usual routine care of property has been continued. The incidental labor in caring for and shipping property was performed by enlisted men of the Engineer Battalion, and by hired civilians. Purchases were continued during the year of various materials, such as submarine-mining supplies, surveying instruments, drawing materials, photographic outfits, bridge and ponton, intrenching, and other field engineering supplies.

The engineering models exhibited at the Pan-American Exposition at Buffalo were transferred to the Charleston Exposition.

In connection with the work of the depot, various reports were rendered to the Chief of Engineers on condition of ponton material, etc.

3. DEPOT INSTRUMENTS.

Miscellaneous surveying instruments, reconnaissance and drawing materials were purchased during the year under proposal.

Repairing and overhauling instruments on hand in the depot was continued as far as practicable.

Issues of instruments and reconnaissance materials were made to officers engaged on public works and surveys during the year, upon requisitions duly authorized by the Chief of Engineers.

All astronomical, meteorological, surveying, and other instruments, not otherwise disposed of, were transferred to the Engineer Depot at Washington Barracks.

Issues of hygrometers and thermometers for use in magazines of fortifications were made as directed.

4. EQUIPMENT OF ENGINEER TROOPS.

The operations carried on during the year are reported on under two classes: (*a*) Instruments, intrenching tools, etc.; (*b*) completing ponton trains.

(*a*) *Instruments, intrenching tools, etc.*—The principal articles purchased during the year were those covered by various requisitions received from engineer officers serving in the new possessions and Alaska, exploring expeditions, acting engineer officers, etc., and the battalions of engineers. All material for export shipment was carefully packed, all photographic papers were placed in soldered-tin cases, and delicate instruments and blue-print papers, etc., in zinc-lined cases.

(*b*) *Completing ponton trains.*—During the year shipments of ponton material were made to Washington Barracks, Fort Leavenworth, and West Point. A great supply of ponton equipage, the accumulation of years, was inspected and condemned. The shipments to Fort Leaven-

worth included 9 ponton boats, 25 canvas boats, 298 anchors, 177 ponton wagons, 62 chess wagons, 7 battery and forge wagons, and 7 tool wagons.

SUBMARINE-MINING MATERIAL.

Purchases of submarine-mining material under the various allotments have been made as authorized. By act of Congress of March 2, 1901, the care and operation of the torpedo defense devolve upon the artillery, and pursuant to directions from the Chief of Engineers, the entire torpedo material on hand in the depot was transferred on March 14, 1902, to Capt. George F. Landers, Artillery Corps, at Fort Totten, who had been designated to receipt for the same by the commanding officer, Fort Totten. Such purchases as are authorized by the Chief of Engineers are still being made by this office. On February 1, 1902, a statement was submitted to the Chief of Engineers showing material still required to be purchased, amounting to $34,406.20. With this exception, the supply for all harbors has been practically completed.

Reports of engineer officers to the Chief of Engineers of their semiannual inspection of submarine-mining materials have been referred to this office for remark and return to the Chief of Engineers.

Repairs have been made to such portions of the torpedo material as were practicable, such as circuit regulators, circuit closers, compound plugs, etc.

The Torpedo Manuals, edition 1898, have been called in, and forwarded to the Chief of Engineers.

MUSEUM AND LIBRARY BUILDING AT WILLETS POINT.

Plans for the construction of the addition to the library building were prepared and an architect engaged on preliminary studies. Owing to the removal of the Engineer School to Washington Barracks, the library building was transferred to the artillery, and the funds still remaining were transferred to Maj. William L. Marshall, Corps of Engineers, who since January 6, 1902, has been charged with the construction of this addition.

Shipments from the depot during the year were made as follows:

Date.	Character of shipments.	Value.	Weight.
	Lieut. Col. C. E. L. B. Davis, Corps of Engineers, Manila, P. I.:		*Pounds.*
Apr. 28, 1902	Instruments and blue-print paper	$1,866.00	2,499
June 18, 1902	Cavalry sketching cases, etc	191.50	131
	Maj. C. B. Sears, Corps of Engineers, Manila, P. I.:		
July 16, 1901	600 rolls blue-print paper and cloth	1,480.00	2,559
Dec. 19, 1901	Aristo platinum printing paper	65.00	47
Jan. 7, 1902	Transit, instruments, drawing materials, etc	1,975.00	1,680
	Commanding officer, Second Battalion of Engineers, Manila, P. I.:		
July 17, 1901	Astronomical instruments, carpenters' and plumbers' tools, and sundries; meteorological, surveying, and drawing instruments, and intrenching tools	7,716.00	10,590
Nov. 15, 1901	Repair kits for steel tapes, instruments, etc	162.00	26
	Capt. Henry Jervey, Corps of Engineers, Manila, P. I.:		
July 8, 1901	47 professional books	125.00	129
	Capt. William W. Harts, Corps of Engineers, Manila, P. I.:		
Feb. 27, 1902	Steel tapes, repair kits for steel tapes, etc	120.00	81
Mar. 1, 1902	96 yards cotton duck, 22-inch	58.00	190
	Capt. Robert McGregor, Corps of Engineers, Iloilo, Panay, P. I.:		
Mar. 20, 1902	Steel tape, 100-meter	55.00	48
	Capt. Jas. J. Morrow, Corps of Engineers, Zamboanga, P. I.:		
Mar. 20, 1902	Printing frames and plate glasses for same	85.00	407
	Total for Philippine Islands	13,898.50	18,387

Date.	Character of shipments.	Value.	Weight.
	Maj. William M. Black, Corps of Engineers, Washington Barracks, D. C.:		*Pounds.*
Oct. 30, 1901	Professional books		723
Nov. 16, 1901	Books and official records		103
Jan. 30, 1902	Cement-testing apparatus	$700.00	825
Feb. 13, 1902	Triple wire, fuses, etc	260.00	565
Feb. 27, 1902	Chemical, photographic, and electrical apparatus	1,438.00	2,351
Mar. 17, 1902	Fish torpedo parts, official records	5,730.00	22,522
Mar. 18, 1902	Official records		226
Mar. 25, 1902	Gabions, chains, sap shields, etc	1,910.00	45,608
Mar. 25, 1902	Shovels, 1,950	975.00	10,400
Mar. 29, 1902	Instruments, tools, sand bags, etc	4,146.70	25,851
Apr. 3, 1902	Astronomical instruments, etc	6,025.00	7,494
Apr. 5, 1902	Instruments and rope	2,070.00	8,212
Apr. 12, 1902	Sand bags, rope, records, etc	1,270.00	21,099
Apr. 15, 1902	Rope, shovels, spades, etc	3,975.00	42,647
Apr. 15, 1902	Tide gauge paper	370.00	720
Apr. 19, 1902	Instruments, tools, paints, etc	6,050.00	24,327
Apr. 24, 1902	Harness, tools, paints, instruments, lithographing apparatus	1,980.00	19,478
Apr. 29, 1902	Records, tools, tide-gauge paper, etc	3,841.00	22,202
Apr. 29, 1902	Photographic materials, derrick apparatus, etc	687.00	4,956
Apr. 29, 1902	Books, stationery, etc		294
May 1, 1902	Photographic materials, tools, etc	533.00	5,161
May 3, 1902	Tools, map cases, etc	1,127.00	5,111
May 3, 1902	Pocket range finder and passometer	15.08	
May 6, 1902	Nails, spikes, and pitch	248.00	11,947
May 8, 1902	Blacksmith tools, etc	2,203.40	15,049
May 10, 1902	Wire, jacks, blocks, lead, machetes, etc	1,116.10	7,346
May 15, 1902	Axes	12.00	60
May 17, 1902	Tools, rope, instruments, etc	722.00	4,290
May 15, 1902	Tools, canvas, lanterns, etc	825.00	4,276
May 20, 1902	Iron, tools, tide-gauge paper, wire, etc	1,899.00	28,638
May 22, 1902	Tools, stationery, instruments, etc	1,285.00	3,944
May 27, 1902	Tools, rope, wire, waste, etc	1,140.00	7,477
May 29, 1902	Tools, records, etc	490.00	2,967
June 11, 1902	Tools, materials, etc	1,956.03	10,266
June 12, 1902	Tools, etc	616.26	6,712
June 13, 1902	Do	606.84	6,089
June 17, 1902	Do	627.14	7,983
June 20, 1902	Do	637.11	6,108
June 26, 1902	Miscellaneous property	280.80	3,740
June 27, 1902	Do	6.50	150
	Commanding officer Third Battalion of Engineers, Washington Barracks, D. C.:		
Oct 24, 1901	Miscellaneous instruments and drawing materials, etc	553.00	629
Nov. 21, 1901	Spikes, adze handles, etc	33.00	800
Dec. 5, 1901	Battalion records		759
Dec. 19, 1901	Official records		35
	Capt. Charles H. McKinstry, Corps of Engineers, commanding Company K, Third Battalion of Engineers, Washington Barracks:		
Dec. 3, 1901	Miscellaneous drawing instruments	100.00	60
	Commanding officer Company I, Third Battalion of Engineers, Washington Barracks:		
Nov. 1, 1901	Tools, hardware, etc	448.00	926
	Commanding officer Company K, Third Battalion of Engineers, Washington Barracks:		
Nov. 1, 1901	Tools, hardware, etc	448.00	924
	Commanding officer Company L, Third Battalion of Engineers, Washington Barracks:		
Nov. 1, 1901	Tools, hardware, etc	448.00	904
	Total for Washington Barracks	59,753.41	402,956
	Maj. Smith S. Leach, Corps of Engineers, Fort Leavenworth, Kans.:		
Mar. 1, 1902	Portable searchlight outfit	8,500.00	26,373
Mar. 18, 1902	Rope, shovels, and spikes	150.00	3,280
Mar. 27, 1902	Picks, carpenters' tool chests and tools, lumber	510.00	42,455
Apr. 5, 1902	Instruments, tools, etc	1,425.00	1,763
Apr. 17, 1902	Blacksmiths' tools, photographic supplies, etc	685.00	3,422
Apr. 29, 1902	Tent poles for dark tent	5.00	16
Apr. 29, 1902	Tracing cloth	12.00	15
May 1, 1902	Blue-printing and drawing materials	297.00	717
May 29, 1902	3 rolls blue-print paper	5.00	7
June 2, 1902	24 martingales	15.00	81
June 5, 1902	Ponton equipage	98,179.10	711,910
June 17, 1902	Ponton parts	116.42	4,069
June 21, 1902	Neostyle supplies	51.00	117
June 21, 1902	Plates of ponton equipage	5.00	60
	Commanding officer, Company A, First Battalion Engineers, Fort Leavenworth, Kans.:		
Nov. 26, 1901	Wheelbarrows, tools, etc	417.00	1,224
	Commanding officer, First Battalion Engineers, Fort Leavenworth, Kans.:		
Dec. 5, 1901	Mimeograph, blue-printing outfit, instruments, etc	380.00	1,087

Date.	Character of shipments.	Value.	Weight.
	Capt. Thomas H. Rees, Corps of Engineers, Fort Leavenworth, Kans.:		*Pounds.*
Dec. 19, 1901	3 Oliver typewriter ribbons	$1.69	
Jan. 9, 1902	Parts of Wells light, spikes; tools, etc	20.00	341
	Lieut. Sherwood A. Cheney, Corps of Engineers, Fort Leavenworth, Kans.:		
June 3, 1902	Paint and paint brushes	91.50	817
	Capt. George A. Zinn, Corps of Engineers, Fort Leavenworth, Kans.:		
May 14, 1902	Professional books	23.58	
	Capt. Clement A. F. Flagler, Corps of Engineers, Fort Leavenworth, Kans.:		
June 25, 1902	Professional books	18.30	
	Capt. James B. Cavanaugh, Corps of Engineers, Fort Leavenworth, Kans.:		
June 30, 1902	Professional books	36.00	
	Total for Fort Leavenworth, Kans	110,943.59	797,754
	Capt. Joseph E. Kuhn, Corps of Engineers, West Point, N. Y.:		
July 5, 1901	100 machetes	150.00	210
July 9, 1901	Shovels and picks	12.00	56
Aug. 27, 1901	50 boat paddles	75.00	200
Sept. 2, 1901	Engineering instruments, etc	630.00	297
Sept. 9, 1901	1 Oliver typewriting machine	75.00	48
Sept. 20, 1901	Miscellaneous drawing materials	35.00	70
Oct. 29, 1901	Ponton wagons, chess wagons, battery and forge wagons, tools, and hardware	5,065.00	27,646
Nov. 1, 1901	Tools, instruments, machines, etc	753.00	1,547
Nov. 30, 1901	Abbot's protractors	24.00	
Apr. 21, 1902	Pedometer and range finders	31.97	
	Total for West Point, N. Y	6,850.97	30,074
	Maj. Harry F. Hodges, Corps of Engineers, Habana, Cuba:		
Feb. 27, 1902	Cavalry sketching cases, compasses, etc	360.00	167
	Total for Cuba	360.00	167
	Lieut. Howard R. Hickok, Ninth Cavalry, acting engineer officer, Fort St. Michael, Alaska:		
Aug. 19, 1901	Photographic supplies	100.00	351
	Total for Alaska	100.00	351
	Balance of United States.		
	Capt. Robert E. L. Michie, Twelfth Cavalry, acting engineer officer, Department Missouri, Omaha, Nebr.:		
Oct. 12, 1901	Sketching cases, books on map reading, and 1 roll of paper	110.00	103
	Maj. Smith S. Leach, Corps of Engineers, Omaha, Nebr.:		
Apr. 29, 1902	Drawing paper, tracing linen, etc	32.31	
	Lieut. James F. McKinley, Fourteenth Cavalry, acting engineer officer, San Francisco, Cal.:		
Sept. 16, 1901	Cavalry sketching cases	100.00	32
	Commanding officer, Artillery District, San Francisco, Cal.:		
May 31, 1902	Willyoung testing set and battery	200.00	92
	Capt. E. D. Scott, Artillery Corps, San Diego Barracks, Cal.:		
Mar. 1, 1902	Hygrometer and thermometers	8.00	
	Capt. James B. Cavanaugh, Corps of Engineers, Jefferson Barracks, Mo.:		
Mar. 13, 1902	Rope, tools, drawing materials, etc	350.00	907
	Lieut. Frederick T. Arnold, Fourth Cavalry, acting engineer officer, Jefferson Barracks, Mo.:		
Oct. 22, 1902	Miscellaneous drawing instruments and materials	200.00	65
	Lieut. Sherwood A. Cheney, Corps of Engineers, Jefferson Barracks, Mo.:		
Mar. 29, 1902	Rope, tools, drawing materials	236.50	826
	Maj. George E. Pond, quartermaster, acting engineer officer, St. Paul, Minn.:		
Aug. 8, 1901	Pedometers, cavalry sketching cases, etc	100.00	88
	Acting engineer officer, headquarters Department Dakota, St. Paul, Minn.:		
Oct. 10, 1901	Transit, level, rods, and tripods	270.00	119
	Lieut. A. A. Maybach, Artillery Corps, Fort Terry, N. Y.:		
Nov. 12, 1901	Hygrometers and thermometers	10.00	12
	Lieut. George F. Brady, Fourteenth Infantry, acting engineer officer, Fort Niagara, N. Y.:		
Nov. 5, 1901	Drawing instruments and materials	85.00	55
	Maj. William T. Rossell, Corps of Engineers, Tompkinsville, N. Y.:		
Mar. 18, 1902	Official records		26
	Acting Engineer officer, Fort Michie, N. Y.:		
Aug. 13, 1901	Hygrometers and thermometers	10.00	17
	Acting engineer officer, Fort Carroll, Md.:		
July 8, 1901	Hygrometers and thermometers	12.00	13
Nov. 19, 1901	1 New York level rod	15.00	45

Date.	Character of shipments.	Value.	Weight.
	Lieut. Samuel G. Shartle, Artillery Corps, Fort Howard, Md.:		*Pounds.*
Mar. 4, 1902	Torpedo materials	$904.45	22,113
Mar. 27, 1902	Do	573.00	1,299
	Capt. L. C. Brown, Artillery Corps, Fort Washington, Md.:		
Dec. 19, 1901	Cavalry sketching cases, thermometers, and tide-gauge paper.	30.00	12
Feb. 14, 1902	Junction boxes and wire mooring rope	840.00	7,600
Feb. 24, 1902	Hygrometers	4.00	
May 13, 1902	Do	6.00	
	United States Engineer Office, Richmond, Va.:		
July 19, 1901	Tide-gauge paper	5.00	22
	Maj. James B. Quinn, Corps of Engineers, Norfolk, Va.:		
Aug. 1, 1901	Hygrometer	2.00	
Aug. 10, 1901	Do	2.00	2
Feb. 6, 1902	Steel tape	9.86	
	Capt. H. C. Davis, Artillery Corps, Fort Monroe, Va.:		
Jan. 6, 1902	6 coppers for signal battery	3.60	
	Maj. Dan C. Kingman, Corps of Engineer, Cleveland, Ohio.:		
July 8, 1901	Transit and steel tapes	200.00	100
Sept. 23, 1902	Transit, level, and tripods	335.00	123
	Capt. Edward F. McGlachlin, Artillery Corps, Fort Walla Walla, Wash.:		
May 29, 1902	Cavalry sketching cases and odometers	24.00	15
	Maj. John Millis, Corps of Engineers, Seattle, Wash.:		
Nov. 19, 1901	2 rolls tide-gauge paper	6.00	21
	Lieut. T. L. Sherburne, Artillery Corps, Fort Lawton, Wash.:		
Dec. 21, 1901	Miscellaneous drawing instruments	200.00	102
Feb. 15, 1902	Drawing materials	20.00	100
	Lieut. L. S. Chappelear, Artillery Corps, Fort Lawton, Wash.:		
Apr. 24, 1902	Cloth for mounting maps	1.20	
	Capt. W. L. Kenly, Artillery Corps, Vancouver Barracks, Wash.:		
Dec. 23, 1901	Cavalry sketching cases	15.90	
	Capt. W. A. Bethel, Artillery Corps, Vancouver Barracks, Wash.:		
Dec. 28, 1901	1 Batson sketching case	35.20	
	Lieut. H. T. Patten, Artillery Corps, Fort Fremont, S. C.:		
Aug. 3, 1901	21 cable drums	378.00	9,555
	Lieut. M. C. Kerth, Twenty-third Infantry, Fort McPherson, Ga.:		
May 6, 1902	Drawing instruments	40.00	44
	Acting engineer officer, Fort Ethan Allen, Vt.:		
Nov. 16, 1901	Drawing materials, etc	415.00	292
Nov. 25, 1901	Prismatic compass	9.50	
	Lieut. Richard Furnival, Artillery Corps, Fort Ethan Allen, Vt.:		
Jan. 13, 1902	Drawing ink	4.32	
	Maj. George W. Goethals, Corps of Engineers, Newport, R. I.:		
Oct. 22, 1901	2 tide gauges and 2 rolls paper	270.00	266
	Capt. H. C. Schumm, Artillery Corps, Fort Adams, R. I.:		
Jan. 25, 1902	Torpedo materials	1,492.00	79,375
	Capt. Samuel A. Kephart, Artillery Corps, Fort Du Pont, Del.:		
Feb. 14, 1902	Torpedo materials	2,324.00	18,337
	Acting engineer officer, headquarters Department of Texas, San Antonio, Tex.:		
Nov. 16, 1901	Reconnaissance instruments and drawing materials	850.00	448
	Capt. Charles S. Riché, Corps of Engineers, Galveston, Tex.:		
Dec. 24, 1901	Submarine-mining materials, etc	2,958.00	12,384
Mar. 1, 1902	Do	3,399.22	8,318
Apr. 10, 1902	Grappling irons, cylinder oil	13.00	185
June 18, 1902	Instruments and drawing materials	430.20	620
	Capt. Robert S. Welsh, Artillery Corps, Fort Dade, Tex.:		
Jan. 16, 1902	Ball seat for circuit closer	1.00	
	Acting engineer officer, Fort Pickens, Fla.:		
Oct. 19, 1901	1 level and tripod	125.00	79
	Capt. Herbert Deakyne, Corps of Engineers, Tampa, Fla.:		
Feb. 4, 1902	6 signal cells	6.00	95
	Capt. Charles J. Bailey, Artillery Corps, acting engineer officer, Great Diamond Island, Me.:		
Sept. 16, 1901	1 transit, with tripod, complete	210.00	50
	Maj. Solomon W. Roessler, Corps of Engineers, Portland, Me.:		
Sept. 19, 1901	5 barometers, aneroid and mercurial	75.00	36
Jan. 18, 1902	Torpedo materials	743.00	7,694
Mar. 6, 1902	Do	300.00	435
	Maj. John G. D. Knight, Corps of Engineers, Chattanooga, Tenn.:		
Mar. 18, 1902	Official records		198
	Mr. C. Donovan, assistant engineer, Port Eads, La. (Lieut. E. M. Adams, Corps of Engineers, New Orleans, La.):		
Sept. 29, 1901	2 rolls tide-gauge paper	6.00	43
	Col. Henry L. Abbot, Corps of Engineers, retired, Cambridge, Mass.:		
Mar. 18, 1902	Official records		171
	Lieut. Daniel F. Craig, Artillery Corps, acting engineer officer, Fort Hancock, N. J.:		
Oct. 12, 1901	Drawing materials	50.00	123
	Capt. W. R. Smith, Artillery Corps, Fort Morgan, Ala.:		
Feb. 24, 1902	Thermometers	9.00	

Date.	Character of shipments.	Value.	Weight.
	Commanding officer, Fort Constitution, Portsmouth, N. H.:		*Pounds.*
Jan. 18, 1902	Torpedo materials	$910.00	12,553
Jan. 18, 1902	1 measuring drum and frame	58.00	228
Mar. 6, 1902	Torpedo materials	208.00	454
	Lieut. Foster R. Walton, Tenth Infantry, Fort Mackenzie, Wyo.:		
Feb. 17, 1902	Prismatic compasses	19.00	
	Total for balance of United States	20,259.26	185,892
	Issued at Willets Point, N. Y., to artillery.		
	Maj. Arthur Murray, Artillery Corps:		
Oct. 15, 1901	194 circuit regulator plugs, staples, etc	293.00	
Oct. 15, 1901	Torpedo material, electric apparatus, etc	18,350.82	
Oct. 26, 1901	Do	11,926.34	
Oct. 29, 1901	Books on torpedoes, etc		
Nov. 6, 1901	Junction boxes, rubber tubing, etc	16.75	
Nov. 9, 1901	58 window shades	17.40	
Nov. 30, 1901	Chloride accumulator elements, etc	346.96	
Dec. 7, 1901	Submarine-mining apparatus and materials	633.41	
Apr. 24, 1902	1 upright boiler	150.00	
June 7, 1902	567 miles single and 138 miles multiple cable	437,150.00	
	Capt. G. F. Landers, Artillery Corps:		
Jan. 8, 1902	Submarine-mining material	139.91	
Jan. 22, 1902	Do	133.60	
Feb. 17, 1902	Do	82.05	
Feb. 18, 1902	Do	51.63	
Mar. 3, 1902	Torpedoes, anchors, and materials	15,936.10	
Mar. 14, 1902	Do	94,598.37	
Apr. 5, 1902	Rubber strips, grappling irons	10.50	
Apr. 5, 1902	18 window shades	5.40	
Apr. 16, 1902	1 boat telephone	45.00	
May 10, 1902	Disconnectors, reversing keys, etc	257.00	
May 29, 1902	Sheet copper for earth plates and pliers	26.00	
June 9, 1902	Pump, side inlet, rope, etc	217.30	
June 20, 1902	Cut-out boxes, turks head collars, etc	50.00	
	Maj. C. D. Parkhurst, Artillery Corps:		
Jan. 15, 1902	5,100 feet copper wire No. 14, loading, gutta-percha	204.00	
	Capt. John W. Ruckman, Artillery Corps:		
Mar. 3, 1902	Dynamite, gun cotton, fuses, powder, etc	1,608.68	
	Total for Willets Point, N. Y., to Artillery Corps	582,250.22	1,775,000
	Issued at Willets Point, N. Y., to Third Battalion of Engineers.		
	Capt. Francis R. Shunk, Corps of Engineers, commanding Company I:		
July 17, 1901	Instruments	580.66	
Sept. 6, 1901	Field outfit, sets of carpenters' and plumbers' tools, and type-writing machine	260.04	
Sept. 10, 1901	4 tool chests with padlocks	50.68	
Sept. 19, 1901	Drawing materials	24.35	
	Capt. Charles H. McKinstry, Corps of Engineers, commanding Company K:		
Sept. 6, 1901	Instruments, field outfits, sets of carpenters' and plumbers' tools	832.20	
Sept. 10, 1901	4 tool chests with padlocks	50.68	
Sept. 19, 1901	Drawing materials	24.35	
	Capt. James F. McIndoe, Corps of Engineers, commanding Company L:		
Sept. 6, 1901	Instruments, field outfit, sets of carpenters' and plumbers' tools	832.20	
Sept. 10, 1901	4 tool chests with padlocks	50.68	
Sept. 19, 1901	Drawing materials	24.35	
	Total for Willets Point, N. Y., to Third Battalion of Engineers	2,730.19	3,000
	Totals.		
	Manila and Philippine Islands	13,898.50	18,387
	Washington Barracks, D. C	59,763.41	402,956
	Fort Leavenworth, Kans	110,943.59	797,754
	West Point, N. Y	6,850.97	30,074
	Cuba	360.00	167
	Alaska	100.00	351
	Balance of United States	20,259.26	185,892
	Willets Point, to artillery	582,250.22	1,775,000
	Willets Point, to Third Battalion of Engineers	2,730.19	3,000
	Grand total	797,146.14	3,213,581

Money statements.

I. For Engineer Depot at Willets Point, N. Y., for fiscal year ending June, 30, 1901:		
July 1, 1901, balance unexpended		$14.41
July 31, 1901, amount turned into Treasury		14.41
II. Engineer Depot at Willets Point, N. Y.:		
1. Act March 2, 1901, for "Incidentals," 1902—		
March 8, 1901, amount allotted		5,000.00
April 19, 1902, received by cash account of overcharge on voucher		1.05
		5,001.05
October 8, 1901, amount taken to Washington Barracks by Maj. W. M. Black		1,800.00
		3,201.05
June 30, 1902, amount expended during fiscal year		3,201.05
2. Act March 2, 1901, for "Materials," 1902—		
March 8, 1901, amount allotted		1,500.00
October 7, 1901, amount taken to Washington Barracks by Maj. W. M. Black	$1,000.00	
June 30, 1902, amount expended during fiscal year	48.54	
		1,048.54
		451.46
October 7, 1901, amount deposited to credit Treasurer United States		451.46
3. Act March 2, 1901, for "Instruments," 1902—		
March 8, 1901, amount allotted		3,000.00
June 30, 1902, amount expended during fiscal year		3,000.00
4. Act March 2, 1901, for "Addition to Building for Models and Library"—		
March 8, 1901, amount allotted		12,000.00
January 6, 1902, amount transferred to Maj. W. L. Marshall		11,750.00
June 30, 1902, amount expended during fiscal year		250.00
5. Act March 2, 1901, for "Library," 1902—		
March 8, 1901, amount allotted		500.00
October 7, 1901, amount deposited to credit of Treasurer United States	$156.98	
June 30, 1902, amount expended during fiscal year	43.02	
October 7, 1901, amount taken to Washington Barracks by Maj. W. M. Black	300.00	
		500.00
III. Equipment of Engineer Troops, 1901:		
1. For "Instruments, Intrenching Tools, etc."—		
July 1, 1901, balance unexpended		.83
July 31, 1901, amount turned into Treasury		.83
2. For "Completing Ponton Trains"—		
July 1, 1901, balance unexpended		6.46
July 31, 1901, amount turned into Treasury		6.46
Fiscal year 1902:		
3. For "Instruments, Intrenching Tools, etc."—		
June 30, 1902, total of allotments received during fiscal year		11,950.00
June 30, 1902, amount expended during fiscal year		11,950.00
4. For "Completing Ponton Trains"—		
June 30, 1902, total of allotments received during fiscal year		7,750.00
June 30, 1902, withdrawn during fiscal year		1,750.00
June 30, 1902, amount expended during fiscal year		6,000.00

IV. Torpedoes for Harbor Defense:		
1. Act March 3, 1899, for "Torpedo Experiments"—		
July 1, 1901, balance unexpended		1,893.72
October 1, 1901, amount taken to Washington Barracks by Maj. W. M. Black	$1,000.00	
June 30, 1902, amount expended during fiscal year	893.72	
		1,893.72
2. Act May 25, 1900, for "Purchase of Submarine-Mining Materials, etc."—		
July 1, 1901, balance unexpended		3,147.03
June 30, 1902, amount expended during fiscal year		3,147.03
3. Act March 1, 1901, for "Purchase of Submarine-Mining Materials, etc."—		
July 1, 1901, balance unexpended		16,300.00
June 30, 1902, amount withdrawn during fiscal year		5,800.00
		10,500.00
October 7, 1901, amount taken to Washington Barracks by Maj. W. M. Black	$5,300.00	
June 30, 1902, amount expended during fiscal year	3,124.61	
July 1, 1902, outstanding liabilities	420.48	
		8,845.09
July 1, 1902, balance available		1,654.91



APPENDIX A.

IMPROVEMENT OF RIVERS AND HARBORS IN MAINE EAST OF AND INCLUDING PORTLAND HARBOR.

REPORT OF MAJ. S. W. ROESSLER, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1902, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Lubec Channel, Maine.
2. Narragaugus River, Maine.
3. Breakwater from Mount Desert to Porcupine Island, Bar Harbor, Maine.
4. Harbor at Sullivan Falls, Maine.
5. Union River, Maine.
6. Bagaduce River, Maine.
7. Penobscot River, Maine.
8. Harbor at Bucksport, Maine.
9. Camden Harbor, Maine.
10. Harbor at Rockland, Maine.
11. Carvers Harbor, Vinalhaven, Maine.
12. Georges River, Maine.
13. Kennebec River, Maine.
14. Portland Harbor, Maine.

UNITED STATES ENGINEER OFFICE,
Portland, Me., July 16, 1902.

GENERAL: I have the honor to forward annual report for the fiscal year 1902 for river and harbor works in my charge.

Very respectfully, your obedient servant,

S. W. ROESSLER,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

A 1.

IMPROVEMENT OF LUBEC CHANNEL, MAINE.

No operations have been carried on this year beyond the inspection of the locality.

It is proposed to apply the appropriation of $53,000, made by act of June 13, 1902, to the dredging of the lower portion of the channel necessary to complete the project.

Money statement.

July 1, 1901, balance unexpended	$639.18
Amount appropriated by river and harbor act approved June 13, 1902	53,000.00
	53,639.18
June 30, 1902, amount expended during fiscal year	122.36
July 1, 1902, balance unexpended	53,516.82
July 1, 1902, outstanding liabilities	100.00
July 1, 1902, balance available	53,416.82

APPROPRIATIONS.

March 3, 1879	$44,000
June 14, 1880	20,000
March 3, 1881	45,000
August 2, 1882	20,000
July 5, 1884	10,000
August 5, 1886	10,000
August 11, 1888	20,000
August 18, 1894	5,000
August 18, 1894, unexpended balance for improving St. Croix River, made available for Lubec channel	35,000
June 3, 1896	32,000
March 3, 1899	25,000
June 13, 1902	53,000
Total	319,000

COMMERCIAL STATISTICS.

Receipts and shipments, 1901.

	Tons.
Bricks	2,500
Coal	3,000
Fish	60,000
Flour and grain	9,000
Lead and tin	15,000
Lumber	14,000
Oil and mustard	12,000
Provisions	5,700
Potatoes	1,500
Salt	4,300
Sardines and herring	38,000
Total	165,000

Arrivals and departures in calendar year 1901.

Steamers, coastwise, draft about 17 feet	476
Sailing vessels, coastwise, draft 14 feet	210
Vessels rebuilt during the year (1 steam and 1 sailing vessel)	2
Vessels built during the year	1

A 2.

IMPROVEMENT OF NARRAGAUGUS RIVER, MAINE.

No operations beyond inspection have been carried on during the year.

Money statement.

July 1, 1901, balance unexpended	$416.19
July 1, 1902, balance unexpended	416.19
July 1, 1902, outstanding liabilities	50.00
July 1, 1902, balance available	366.19

APPROPRIATIONS.

For improvement above Millbridge:		
Act of March 3, 1871	$12,000	
Act of June 10, 1872	10,000	
		$22,000
For improvement below Millbridge:		
Act of August 5, 1886	10,000	
Act of August 11, 1888	10,000	
Act of September 19, 1890	7,500	
Act of July 13, 1892	7,500	
Act of August 18, 1894	5,000	
Act of June 3, 1896	5,000	
Act of March 3, 1899	5,000	
		50,000
Total		72,000

COMMERCIAL STATISTICS.

Receipts and shipments, 1901.

	Tons.
Bricks	120
Coal	1,400
Cooperage	300
Fish (fresh), lobsters, and clams	2,200
General merchandise	9,900
Grain and flour	2,500
Iron, iron pipe, and machinery	255
Lime and cement	152
Lumber	19,300
Salt	207
Sardines and sardine supplies	4,000
Stone	500
Wood	1,100
Total	41,934

Arrivals and departures in calendar year 1901

Steamers (average draft, 8½ feet; total tonnage, 259,880 tons)	450
Sailing vessels (average draft, 9 feet; total tonnage, 24,375 tons)	325
Vessels built during the year (total tonnage, 1,823 tons)	2

A 3.

BREAKWATER FROM MOUNT DESERT TO PORCUPINE ISLAND, BAR HARBOR, MAINE.

No operations beyond inspection have been carried on during the year. It is proposed to expend the additional appropriation recommended in continuing the construction of the breakwater.

Money statement.

July 1, 1901, balance unexpended	$291.28
June 30, 1902, amount expended during fiscal year	80.46
July 1, 1902, balance unexpended	210.82
July 1, 1902, outstanding liabilities	50.00
July 1, 1902, balance available	160.82
Amount (estimated) required for completion of existing project	$230,200.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	50,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

August 11, 1888	$50,000	June 3, 1896	$10,000
September 19, 1890	50,000	March 3, 1899	20,000
July 13, 1892	50,000		
August 18, 1894	10,000	Total	190,000

COMMERCIAL STATISTICS.

Receipts and shipments, 1901.

	Tons.
Cement and lime	700
Coal	7,500
Farm produce	700
Flour and provisions	2,000
General merchandise	2,000
Hay, grain, and straw	8,000
Horses on hoof	250
Lumber	13,500
Sand and gravel	6,000
Wood	1,500
Total	42,150

A 4.

IMPROVEMENT OF HARBOR AT SULLIVAN FALLS, MAINE.

No operations beyond inspection have been carried on during the year. It is proposed to expend the available balance and additional appropriation recommended in continuing the excavation of ledge at Sullivan Falls.

Money statement.

July 1, 1901, balance unexpended	$464.69
Amount appropriated by river and harbor act approved June 13, 1902	5,000.00
July 1, 1902, balance unexpended	5,464.69
July 1, 1902, outstanding liabilities	50.00
July 1, 1902, balance available	5,414.69
Amount (estimated) required for completion of existing project	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

March 3, 1871	$10,000
June 10, 1872	25,000
June 3, 1896	5,000
March 3, 1899	5,000
June 13, 1902	5,000
Total	50,000

COMMERCIAL STATISTICS.

Receipts and shipments, 1901.

	Tons.
Coal	625
Granite	47,000
General merchandise	500
Lumber and wood	1,000
Total	49,125

Arrivals and departures in calendar year 1901.

Steamers, coastwise, average 150 tons, draft less than 10 feet	10
Sailing vessels:	
Coastwise, average 235 tons, draft 10 feet or more	400
Coastwise, average 75 tons, draft less than 10 feet	32

A 5.

IMPROVEMENT OF UNION RIVER, MAINE.

At the beginning of the fiscal year three dredges were at work on the improvement of the river, under contract with Augustus R. Wright. One clam-shell machine, the *Freeport*, was dredging a channel through the bar at the mouth of the river. This part of the work was completed during the month of July, 1901, and the dredge withdrawn from the work, 26,755 cubic yards, measured in scows, mostly mud and sawdust, having been removed during the fiscal year.

Dredge *Neponset*, with orange-peel type of bucket, was at work removing slabs, edgings, etc., in vicinity of Ellsworth. Work was

suspended November 22, 1901, on account of ice forming in the river, and resumed May 6, 1902. During the fiscal year 108,574 cubic yards, measured in scows, of mill waste, etc., was removed. Dredge *Casco*, a dipper type of machine, was at work removing hardpan and bowlders and ledge in the narrows. Work was suspended November 22, 1901, and not resumed again with this dredge until the latter part of June, 1902, the amount of work accomplished during the fiscal year being removal of hardpan and small bowlders, 6,975 cubic yards, scow measurement; removal of large bowlders, 63 cubic yards, place measurement, and removal of ledge and overlying bowlders in the narrows, 5,420 cubic yards, measured in place. A drill scow was set at work in June blasting ledge in the narrows, but none of the rock had been taken up at the end of the fiscal year.

The time limit for completion of the contract has elapsed. The work can easily be completed during the present season, as far as the funds will allow and as is now deemed necessary.

Money statement.

July 1, 1901, balance unexpended	$116,232.83
June 30, 1902, amount expended during fiscal year	77,674.52
July 1, 1902, balance unexpended	38,558.31
July 1, 1902, outstanding liabilities	9,604.67
July 1, 1902, balance available	28,953.64
July 1, 1902, amount covered by uncompleted contracts	26,351.70

APPROPRIATIONS.

July 11, 1870	$15,000
March 3, 1871	15,000
June 3, 1896	15,000
March 3, 1899	15,000
June 6, 1900	115,000
Total	175,000

CONTRACT IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1902.

Name of contractor: Augustus R. Wright.
Date of contract: October 16, 1899.
Date of approval: November 6, 1899.
Time for commencement: April 1, 1900.
Time for completion: In season of 1901. (Waived.)
Rate:
Dredging mill waste, 25 cents per cubic yard.
Dredging hardpan and bowlders, 75 cents per cubic yard.
Excavation of ledge, $6.40 per cubic yard.
Dredging at mouth of river, 18 cents per cubic yard.

COMMERCIAL STATISTICS.

Receipts and shipments, 1901.

	Tons.
Bricks	1,200
Cement and lime	200
Coal	3,000
Fish	200
Gravel	200
Hardware and iron	400
Heads and staves	12,180
Lumber	12,550
Laths and shingles	1,937
General merchandise	4,015
Wood	1,867
Total	37,749

Arrivals and departures in calendar year 1901.

Draft 10 feet, tonnage 125 tons 500
Vessels plying on the river, 3 steamers and 1 tug.

A 6.

IMPROVEMENT OF BAGADUCE RIVER, MAINE.

No operations beyond inspection have been carried on during the year.

It is proposed to apply the available balance and the additional appropriation recommended in continuing the excavation of the channel at Winslow Island.

The improvement is a doubtful public benefit.

Money statement.

July 1, 1901, balance unexpended	$347.81
Amount appropriated by river and harbor act approved June 13, 1902	3,000.00
July 1, 1902, balance unexpended	3,347.81
July 1, 1902, outstanding liabilities	100.00
July 1, 1902, balance available	3,247.81
Amount (estimated) required for completion of existing project	18,875.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	5,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

August 11, 1888	$3,000	March 3, 1899	$3,000
September 19, 1890	4,000	June 13, 1902	3,000
July 13, 1892	5,000		
August 18, 1894	5,000	Total	28,000
June 3, 1896	5,000		

COMMERCIAL STATISTICS.

Receipts and shipments, 1901.

	Tons.
Bricks	9,000
Coal	2,700
Cod and mackerel lines	300
Cotton	350
Farm produce	350
Fish	450
General merchandise	25,000
Grain	12,000
Granite	3,000
Lumber and cooperage	23,000
Lime, cement, etc	12,000
Phosphate	250
Wood	7,500
Total	95,900

Most of the foregoing includes receipts and shipments at Castine, at the mouth of the river.

Arrivals and departures during calendar year 1901.

Steamers:	
Coastwise, draft 10 feet and over, 500 to 1,500 tons	250
Coastwise, draft less than 10 feet, 5 to 250 tons	1,500
Sailing vessels:	
Coastwise, 150 to 400 tons	200
Coastwise, 5 to 150 tons	500

A 7.

IMPROVEMENT OF PENOBSCOT RIVER, MAINE.

The sum of $10,774.63 was expended during the year. There was no work under the general project, operations being confined to the excavation of ledge in front of the Boston and Bangor Steamboat wharf at Bangor, to the depth of 11 feet at extreme low tide, under a contract with Harries & Letteney. The total quantity of ledge taken out at that locality was 2,225 cubic yards, place measurement. At the beginning of the fiscal year 1902 about 65 per cent of this quantity had been removed. The work was entirely finished November 27, 1901. The details of the project for the work at Bangor Harbor are given in the report of the Chief of Engineers.

There is at present no particular item of work to which it is proposed to apply the available balance.

Money statement.

July 1, 1901, balance unexpended	$19,447.50
June 30, 1902, amount expended during fiscal year	10,774.63
July 1, 1902, balance unexpended	8,672.87
July 1, 1902, outstanding liabilities	40.00
July 1, 1902, balance available	8,632.87

APPROPRIATIONS.

March 2, 1829 (for survey)	$300
July 11, 1870 (at Bangor and below)	15,000
March 3, 1871 (at Bangor and below)	50,000
June 10, 1872	40,000
March 3, 1873	20,000
June 23, 1874	20,000
March 3, 1875 ($10,000 to be expended at or near Bucksport Narrows)	25,000
August 14, 1876 ($4,000 to be expended at or near Bucksport Narrows)	10,000
June 18, 1878 ($2,500, or so much thereof as necessary, to be expended at or near Bucksport Narrows)	12,000
March 3, 1879	6,000
July 5, 1884 (for Bangor Harbor and Penobscot River)	20,000
August 5, 1886 (for widening channel at Bangor and removing obstructions near Crosbys Narrows)	15,000
August 11, 1888 ($20,000 to be expended between Bangor and Crosbys Narrows and $30,000 between Bucksport and Winterport)	50,000
September 19, 1890 (for continuing improvement and for dredging near Sterns' mill)	25,000
July 13, 1892	40,000
March 3, 1899	28,000
Total	376,300

CONTRACT IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1902.

Name of contractors: Harries & Letteney.
Date of contract: November 20, 1899.
Date of approval: December 11, 1899.
Time for commencement: May 15, 1900.
Time for completion: October 1, 1901.
Rates:
Dredging, 28.7 cents per cubic yard.
Removing bowlders, $12 per cubic yard.
Ledge excavation, Kenduskeag stream, $15 per cubic yard.
Ledge excavation, steamboat wharf, $7.65 per cubic yard.
Contract completed.

COMMERCIAL STATISTICS.

Receipts and shipments, 1901.

	Tons.
Box shooks	10,095
Bricks	1,390
Cement and lime	8,550
Coal	340,789
Fertilizer	5,730
General merchandise	38,037
Grain, feed, and flour	11,490
Hay	2,620
Ice	51,167
Iron and steel	1,390
Lumber, wood, and cooperage	186,538
Oil	10,150
Salt	1,685
Sand and clay	3,420
Spool bars	8,321
Stone and paving	26,640
Total	708,012

Arrivals and departures during calendar year 1901.

Foreign:	
Steamers, total tonnage, 9,470 tons	8
Sailing vessels, total tonnage, 13,146 tons	43
Coastwise:	
Steamers	842
Sailing vessels	2,142

Total tonnage of coastwise vessels, 1,177,986 tons.

A 8.

IMPROVEMENT OF HARBOR AT BUCKSPORT, MAINE.

The project for improvement at Bucksport Harbor under appropriation of June 13, 1902, is given in detail in the report of the Chief of Engineers. No work was done during the fiscal year 1902.

It is proposed to apply the available funds to dredging in front of the wharves at Bucksport, in accordance with the project.

Money statement.

Amount appropriated by river and harbor act approved June 13, 1902	$20,000.00
July 1, 1902, balance available	20,000.00

APPROPRIATION.

June 13, 1902	$20,000.00

A 9.

IMPROVEMENT OF CAMDEN HARBOR, MAINE.

The appropriation of $7,400 contained in the river and harbor act approved June 13, 1902, will be expended in dredging in the vicinity of the Boston and Bangor Steamboat Company's wharf in the outer harbor, in accordance with the project published in House Doc. No. 263, Fifty-sixth Congress, first session.

Money statement.

July 1, 1901, balance unexpended	$59.21
Amount appropriated by river and harbor act approved June 13, 1902	7,400.00
July 1, 1902, balance available	7,459.21

APPROPRIATIONS.

March 3, 1873	$10,000	August 17, 1894	12,000
June 23, 1874	10,000	June 3, 1896	10,000
March 3, 1875	10,000	June 13, 1902	7,400
August 11, 1888	5,000		
September 19, 1890	6,000	Total	82,400
July 13, 1892	12,000		

A 10.

IMPROVEMENT OF HARBOR AT ROCKLAND, MAINE.

At the beginning of the fiscal year work was in progress under two contracts, one with Dunbar & Sullivan for removal of ledge, and the other with Romano V. Perini for raising the breakwater and placing a heavy stone cap thereon.

The removal of ledge was completed October 3, 1901, 3,620 cubic yards, measured in place, having been accomplished during the fiscal year. The contractor during this time also removed under a supplemental agreement 842 cubic yards, scow measurement, of hardpan and bowlders from what is known as "Lone Rock shoal." This completed work under the contract.

Work under contract with Romano V. Perini for placing riprap and capstone on the breakwater was completed October 15, 1901, 11,757 tons of stone having been so placed. The contractor also removed six stone beacons, as extra work under the contract, at a price previously agreed upon of $50 each, or a total of $300.

A contract was entered into with Eugene S. Belden for placing stone on the outer slope of the outer half of the breakwater. Work was begun October 7, 1901, and completed June 30, 1902. The work was suspended from December 11, 1901, to April 11, 1902, on account of rough weather of winter. Thirty-two thousand six hundred and fifty-six tons of stone were placed during the fiscal year and the work under contract completed.

All work as at present proposed had been completed June 30, 1902.

Money statement.

July 1, 1901, balance unexpended	$162,604.59
June 30, 1902, amount expended during fiscal year	117,198.00
July 1, 1902, balance unexpended	45,406.59
July 1, 1902, outstanding liabilities	9,224.68
July 1, 1902, balance available	36,181.91

APPROPRIATIONS.

June 14, 1880	$20,000	August 18, 1894	$30,000
August 2, 1882	40,000	June 3, 1896	25,500
July 5, 1884	40,000	June 4, 1897	350,000
August 5, 1886	22,500	July 1, 1898	300,000
August 11, 1888	30,000		
September 19, 1890	37,500	Total	925,500
July 13, 1892	30,000		

CONTRACTS IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1902.

For ledge excavation:
Name of contractor: Dunbar & Sullivan.
Date of contract: July 9, 1898.
Date of approval: August 22, 1898.
Time for commencement: September 1, 1898.
Time for completion: September 1, 1901.
Rates:
Removing ledges, $6.75 and $6.25 per cubic yard.
Removing Lone Rock Shoal, 75 cents per cubic yard.
Contract completed.
For raising breakwater:
Name of contractor: Romano V. Perini.
Date of contract: June 2, 1900.
Date of approval: June 18, 1900.
Time for commencement: July 20, 1900.
Time for completion: December 31, 1901.
Rate: $1.49 per ton of stone.
Contract completed.
For placing stone on outer slope of breakwater:
Name of contractor: Eugene S. Belden.
Date of contract: September 17, 1901.
Date of approval: October 5, 1901.
Time for commencement: November 8, 1901.
Time for completion: In 150 working days.
Rate: 87 cents per ton.
Contract completed.

COMMERCIAL STATISTICS.

Receipts and shipments, 1901.

	Tons.
Brick, cement, and sand	3,000
Coal	75,000
Fish, salt, etc	17,500
General merchandise	75,000
Grain and flour	13,500
Hay and straw	1,500
Ice	7,500
Lime	160,000
Lumber and ship timbers	35,000
Oil	675
Stone	79,500
Sawdust and ashes	2,000
Steel rails and iron castings	2,000
Wood and cooperage	50,000
Total	522,175

Arrivals and departures during calendar year 1901.

Steamers:	
Coastwise, 400 to 1,500 tons each	700
Coastwise, 25 to 400 tons each	2,200
Coastwise, under 25 tons	315
Sailing vessels:	
Foreign, tonnage not stated	50
Coastwise	3,375
For refuge	1,375

A 11.

IMPROVEMENT OF CARVERS HARBOR, VINALHAVEN, MAINE.

No operations were carried on during the fiscal year.

It is proposed to apply the available balance and the additional appropriation recommended in continuing the dredging of the harbor in accordance with the project.

Money statement.

July 1, 1901, balance unexpended	$788.86
Amount appropriated by river and harbor act approved June 13, 1902	20,000.00
	20,788.86
June 30, 1902, amount expended during fiscal year	.55
July 1, 1902, balance unexpended	20,788.31
July 1, 1902, outstanding liabilities	150.00
July 1, 1902, balance available	20,638.31
Amount (estimated) required for completion of existing project	19,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	19,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS

June 3, 1896	$10,000
March 3, 1899	15,000
June 13, 1902	20,000
Total	45,000

COMMERCIAL STATISTICS.

Receipts and shipments, 1901.

	Tons.
Coal, hay, wood, lumber, and general merchandise	12,250
Fish, salt, ice, bait, etc	13,500
Lobsters	650
Stone	51,900
Total	78,300

Arrivals and departures during calendar year 1901.

Draft 9 to 18 feet, 100 to 400 tons	225
Draft 7 to 14 feet, 7 to 200 tons	710
Vessels for refuge	525
Small boats making from 6,000 to 7,000 trips per year, 4 to 8 feet draft, 5 to 15 tons each	110

One sloop yacht built last year, 15 tons.
One sloop for fishing, built, 10 tons.
One schooner of 200 tons, building.

A 12.

IMPROVEMENT OF GEORGES RIVER, MAINE.

No operations were carried on during the fiscal year.

It is proposed to apply the available balance to dredging the upper end of the proposed channel, in completion of the project.

Money statement.

July 1, 1901, balance unexpended	$212.62
Amount appropriated by river and harbor act approved June 13, 1902	6,000.00
	6,212.62
June 30, 1902, amount expended during fiscal year	.56
July 1, 1902, balance unexpended	6,212.06
July 1, 1902, outstanding liabilities	100.00
July 1, 1902, balance available	6,112.06

APPROPRIATIONS.

Act of June 3, 1896	$10,000
Act of March 3, 1899	10,000
Act of June 13, 1902	6,000
Total	26,000

COMMERCIAL STATISTICS.

The following letter has been received:

THOMASTON, ME., *January 8, 1902.*

DEAR SIR: The commercial statistics for Georges River, Thomaston, Me., are practically the same as for the year 1899, with the exception of vessels built, which are as follows: Four vessels, total tonnage 5,717 tons. No vessels in process of construction, although I understand that three are to be built, and possibly more.

Very truly, yours,

ATWOOD LEVENSALER.

Maj. S. W. ROESSLER.

A 13.

IMPROVEMENT OF KENNEBEC RIVER, MAINE.

No operations were in progress at the beginning of the fiscal year.

An examination made after the unusually high and prolonged freshet in the spring of 1902 showed that Beef Rock shoal, which had been dredged in 1892 to a depth of 14 feet at mean low tide, had shoaled about 3 feet, giving a depth of about 11 feet at mean low tide, and

that a bad shoal had developed in the channel west of Swan Island, abreast of Theobalds Point, giving a depth of about 8 feet at mean low water and obstructing the passage of the steamboats of the Boston and Kennebec River line. The deepening of the channels at these points being urgent, a dredge has been hired without advertising for excavating the former to the original depth of 14 feet and the latter to a depth of 11 feet, at a cost of 26 cents per cubic yard, scow measurement. The material excavated is a hard deposit of fine sand or gravel.

By the act of June 13, 1902, Congress adopted the project suggested in House Doc. No. 262, Fifty-sixth Congress, first session, which aims to secure a depth of 11 feet at mean low tide between Gardiner and Augusta, at an estimated cost of $81,000, appropriated $40,000 for the work, and authorized the pledging under contract of the remainder.

It is proposed to apply a portion of the balance available for general improvement in dredging in the vicinity of Swan Island, and the funds, available and recommended, for the work between Gardiner and Augusta, to the dredging of the projected channel.

Money statements.

GENERAL IMPROVEMENT.

July 1, 1901, balance unexpended	$27,634.65
June 30, 1902, amount expended during fiscal year	558.12
July 1, 1902, balance unexpended	27,076.53
July 1, 1902, outstanding liabilities	1,997.10
July 1, 1902, balance available	25,079.43

BETWEEN GARDINER AND AUGUSTA.

Amount appropriated by river and harbor act approved June 13, 1902	$40,000.00
July 1, 1902, balance available	40,000.00
Amount (estimated) required for completion of existing project	41,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	41,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATIONS.

March 2, 1827	$4,000	June 23, 1874	$12,000
March 19, 1828	3,500	March 3, 1875	15,000
April 23, 1830	5,000	March 3, 1881	10,000
August 30, 1852	6,000	August 11, 1888	75,000
June 23, 1866	20,000	September 19, 1890	50,000
March 2, 1867	30,000	July 13, 1892	100,000
April 10, 1869	14,850	August 18, 1894	50,000
July 11, 1870	15,000	June 3, 1896	55,000
March 3, 1871	15,000	June 13, 1902	40,000
June 10, 1872	8,000		
March 3, 1873	12,000	Total	540,350

COMMERCIAL STATISTICS.

Receipts and shipments, 1901.

	Tons.
Bricks	1,625
Cement and plaster	1,000
Coal	120,005
General merchandise	19,360
Grain, feed, and hay	1,550
Granite	5,889
Ice	250,000
Iron	4,675
Lumber	97,474
Sand	34,520
Ship timbers	3,100
Wood	3,428
Total	542,626

Arrivals and departures during calendar year 1901.

Steamers:	
Coastwise, about 1,500 tons, draft 10 feet	600
Coastwise, about 75 tons	750
Sailing vessels:	
Foreign, about 100 tons	8
Coastwise, average 800 tons, draft about 13 feet	800
Tugs plying on river	8
Ferryboats	2
Vessels built during the year (total, 30,716 tons)	29

A 14.

IMPROVEMENT OF PORTLAND HARBOR, MAINE.

During the fiscal year ending June 30, 1902, a contract with the Morris & Cumings Dredging Company was in force for dredging the harbor, under project of 1896, to a depth of 30 feet at mean low tide.

Three dredges were employed for this work during the entire year, except dredge No. 5, which caught on fire and sunk May 30, 1901, and did not return to the work until November 16, 1901.

The quantities removed by the three dredges during the fiscal year are as follows:

1,575,580 cubic yards, scow measurement, or
1,355,208 cubic yards, situ measurement.

The excess of scow over situ measurement was 220,372 cubic yards, or 16.26 per cent.

The amount remaining to be dredged during the next fiscal year in completion of the project is about 500,000 cubic yards, situ measurement.

The areas which remain to be completed are as follows:

A small area of the middle ground at its lower or northeasterly end containing about 6.6 acres and an area containing about 6.5 acres in the upper part of the harbor near the southerly limit of the project.

The expenditures during the fiscal year 1902 were $185,996.49.

Money statement.

July 1, 1901, balance unexpended	$283,552.57
June 30, 1902, amount expended during fiscal year	185,996.49
July 1, 1902, balance unexpended	97,556.08
July 1, 1902, outstanding liabilities	29,344.95
July 1, 1902, balance available	68,211.13
July 1, 1902, amount covered by uncompleted contracts	61,904.47

APPROPRIATIONS.

July 4, 1836, for breakwater	$10,000.00
March 3, 1837, for breakwater	25,000.00
July 7, 1838, for breakwater	26,366.00
June 23, 1866, for extending breakwater, but unexpended balance made available for excavating middle ground by joint resolution of June 5, 1868	105,111.05
July 11, 1870, for improving harbor	10,000.00
March 3, 1871, for improving harbor	40,000.00
June 10, 1872, for improving Portland Harbor and Back Bay	45,000.00
March 3, 1873, for improving harbor	50,000.00
June 23, 1874, for improving harbor	20,000.00
March 3, 1875, for improving harbor	20,000.00
March 3, 1881, for improving harbor	20,000.00
August 2, 1882, for improving harbor	35,000.00
July 5, 1884, for improving harbor	30,000.00
August 5, 1886, for improving harbor	30,000.00
August 5, 1886, for Back Cove	26,250.00
August 11, 1888, for improving harbor	40,000.00
August 11, 1888, for Back Cove	25,000.00
September 19, 1890, for improving harbor	40,000.00
September 19, 1890, for Back Cove	25,000.00
July 13, 1892, for improving harbor	30,000.00
July 13, 1892, for Back Cove	20,000.00
August 18, 1894, for Back Cove	20,000.00
June 3, 1896	20,000.00
June 4, 1897	350,000.00
July 1, 1898	200,000.00
March 3, 1901	21,000.00
Total	1,283,727.05

CONTRACT IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1902.

Name of contractor: Morris and Cumings Dredging Company.
Date of contract: July 13, 1900.
Date of approval: August 13, 1900.
Time for commencement: October 14, 1900.
Time for completion: July 13, 1902. (Waived.)
Rate:
For dredging, exclusive of 29-foot area, 13.85 cents per cubic yard.
For dredging 29-foot area, 16½ cents per cubic yard.

COMMERCIAL STATISTICS.

Receipts and shipments, 1901.

	Tons.
Apples	10,219
Asbestos	4,500
Beef and pork	65,146
Box shooks	13,781
Brick	857
Brimstone	17,726
Cattle on hoof	20,217
Cement, lime, hair, plaster, clay, and fertilizer	77,538
Coal	1,084,878
Cotton	8,808
Deals	4,293
Fish, clams, and lobsters	58,658
General merchandise	252,687
Grain, feed, flour, and provisions	555,805
Leather and hides	6,954
Lumber and cooperage	93,764
Machinery and iron	7,615
Mahogany	182
Molasses and sugar	20,927
Oil and oilcloth	24,327
Paper stock, printing paper, and rags	34,300
Rope, sisal and hemp	2,000
Salt	15,069
Sand and stone	41,659
Sheep	2,028
Soda	3,950
Sulphur	29,339
Tin	4,288
Total	2,461,515

Arrivals and departures during calendar year 1901.

Steamers:	
Foreign, draft 22 to 25 feet, tonnage 2,000 to 2,500 tons	393
Foreign, draft 11 to 18 feet, tonnage 1,600 to 2,000 tons	472
Coastwise, draft 22 to 25 feet, about 2,000 tons	773
Coastwise, draft 14 to 18 feet, 900 to 1,000 tons	453
Coastwise, draft about 10 feet	2,468
Barges, 16½ feet, about 1,550 tons	64
Tugs	267
Sailing vessels:	
Foreign, draft 16 feet or more, more than 251 tons	112
Barges, about 2,000 tons	22
Coastwise, draft 16 feet or more, 1,000 tons or over	250
Coastwise, draft less than 16 feet, less than 1,000 tons	87
Barges	77
Coastwise, tonnage and draft not stated	2,361

Two new lines of foreign steamers were established.
Two steamers and one barge were built.

APPENDIX B.

IMPROVEMENT OF RIVERS AND HARBORS IN MAINE SOUTH OF PORTLAND HARBOR, IN VERMONT AND NEW HAMPSHIRE, IN MASSACHUSETTS NORTH OF LYNN HARBOR, AND IN NEW YORK ON LAKE CHAMPLAIN.

REPORT OF CAPT. HARRY TAYLOR, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1902, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Saco River, Maine.
2. Harbor at Cape Porpoise, Maine.
3. Harbor at Isles of Shoals, Maine.
4. Cocheco River, New Hampshire.
5. Exeter River, New Hampshire.
6. Harbor of refuge at Little Harbor, New Hampshire.
7. Harbor at Newburyport, Massachusetts.
8. Merrimac River, Massachusetts.
9. Powow River, Massachusetts.
10. Harbor of refuge at Sandy Bay, Cape Ann, Massachusetts.
11. Harbor at Rockport, Massachusetts.
12. Harbor at Gloucester, Massachusetts.
13. Harbor at Manchester, Massachusetts.
14. Harbor at Beverly, Massachusetts.
15. Sea wall at Marblehead, Massachusetts.
16. Harbor at Burlington, Vermont.
17. Otter Creek, Vermont.
18. Harbor at Plattsburg, New York.
19. Narrows of Lake Champlain, New York and Vermont.
20. Removing sunken vessels or craft obstructing or endangering navigation.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., July 21, 1902.

GENERAL: I have the honor to transmit herewith annual report upon the works of river and harbor improvement in my charge for the fiscal year ending June 30, 1902.

Very respectfully, your obedient servant,

HARRY TAYLOR,
Captain, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

B 1.

IMPROVEMENT OF SACO RIVER, MAINE.

The approved project and the report of progress of the work to June 30, 1902, may be found in Part I, page 77, of this report.

No operations were in progress during the past fiscal year, and the condition of the improvement is the same as on June 30, 1901.

* * * * * * *

Money statement.

July 1, 1901, balance unexpended	$5,241.63
July 1, 1902, balance unexpended	5,241.63
Amount (estimated) required for completion of existing project	70,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	70,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of—	
March 2, 1827, for piers, buoys, and removing obstructions at and near entrance	$7,000
June 23, 1866, for repairing piers	40,000
March 2, 1867, for improving river	40,000
July 25, 1868, for improving river	20,000
April 10, 1869, for improving river	22,275
July 11, 1870, for improving river	10,000
March 3, 1871, for improving river	15,000
June 10, 1872, for improving river	15,000
July 5, 1884, for breakwater	15,000
August 5, 1886, for breakwater	12,500
August 5, 1886, for improving river	12,500
August 11, 1888, for breakwater	12,500
August 11, 1888, for improving river	10,000
September 19, 1890, for improving river, including breakwater and jetty	65,000
July 13, 1892, for improving river, including breakwater	25,000
August 18, 1894, for improving river, including breakwater	10,000
June 3, 1896, for improving river, including breakwater	10,000
March 3, 1899	5,000
Total	346,775

COMMERCIAL STATISTICS, 1901.

* * * * * * *

	Tons.
Coal	36,140
Iron	485
Bricks	6,000
Total	42,625

Arrivals and departures.

Sailing vessels with an average draft of 12 feet and average tonnage of 300:	
Coastwise	110
Foreign	1

B 2.

IMPROVEMENT OF HARBOR AT CAPE PORPOISE, MAINE.

The approved project and the report of progress of the work to June 30, 1902, may be found in Part I, page 79, of this report.

At the beginning of the fiscal year the dredging of the harbor had been completed, the only work remaining to be done to complete the

project being the removal of about 370 cubic yards of ledge which had been uncovered by the dredging. This ledge was removed during the past fiscal year under contract with John J. Fitzpatrick, which completed the improvement of this harbor as projected,

The harbor in its original condition was much used as a harbor of refuge for small vessels in bad weather, and is now available for vessels up to 15 feet draft.

* * * * * * *

Money statement.

July 1, 1901, balance unexpended	$12,840.54
June 30, 1902, amount expended during fiscal year	5,340.54
July 1, 1902, balance unexpended	7,500.00

APPROPRIATIONS.

Act of—	
March 3, 1899	$70,000
June 6, 1900	10,000
Total	80,000

Contract in force during fiscal year ending June 30, 1902.

Contractor: John J. Fitzpatrick, Plattsburg, N. Y.
Total price for removing ledge (estimated quantity, 370.6 cubic yards): $4,218.
Date of contract: April 15, 1901.
Date of approval: April 27, 1901.
Date of commencement: July 1, 1901.
Date of completion: September 30, 1901.

COMMERCIAL STATISTICS.

The harbor up to the present time has been used principally as a harbor of refuge for fishermen, but an electric road 22 miles long has been built from Cape Porpoise to the manufacturing town of Sanford, Me., and an official of the road has stated that it is expected a line of steamers will be put on between Cape Porpoise and Boston, and perhaps Portland; and further, that it is proposed to bring all the coal used in Sanford and all raw material for the mills into this port. It is reported that eight large fishing vessels make this harbor their home port. About 21,000 tons of coal was brought into the harbor during the past year, partly by sailing vessels and partly by barges, with an average draft of 18 feet.

B 3.

IMPROVEMENT OF HARBOR AT ISLES OF SHOALS, MAINE.

A description of this work may be found in Part I, page 79, of this report.

Nothing has been done toward this improvement since 1821–1823, when a breakwater was constructed between Smuttynose and Cedar islands. This breakwater has long since been beaten down by the sea nearly to the level of low water.

The river and harbor act of June 13, 1902, appropriated $30,000 for the completion of the improvement of this harbor in accordance with

report submitted in House Doc. No. 255, Fifty-sixth Congress, first session. The proposed improvement consists in constructing a breakwater to a height of about 15 feet above mean low tide, on the site of the old breakwater, which has been so beaten down and spread out by the sea that it affords no protection at high water. The project for the work has not yet been submitted.

* * * * * * *

Money statement.

Amount appropriated by river and harbor act approved June 13, 1902..	$30,000.00
July 1, 1902, balance unexpended	30,000.00

APPROPRIATIONS.

Act of—	
March 3, 1821	$2,500.00
May 7, 1822	11,500.00
Total	14,000.00
Carried to surplus fund in 1824	748.39
	13,251.61
June 13, 1902	30,000.00
	43,251.61

COMMERCIAL STATISTICS.

Shipments and receipts.

	Tons.
Coal	500
Merchandise	5,000
Fish	2,000
Lumber	210
Total	7,710

During the summer months there is a line of steamers making two trips daily between this port and Portsmouth, N. H.

It is reported that about 1,000 schooners and small steamers frequented the harbor during the past year.

B 4.

IMPROVEMENT OF COCHECO RIVER, NEW HAMPSHIRE.

The approved project and the report of progress of the work to June 30, 1902, may be found in Part I, page 80, of this report.

No operations have been in progress during the fiscal year, and at the date of this report the condition of the improvement is the same as on June 30, 1901.

* * * * * * *

Money statement.

July 1, 1901, balance unexpended	$6,075.21
Amount appropriated by river and harbor act approved June 13, 1902	30,000.00
July 1, 1902, balance unexpended	36,075.21
Amount (estimated) required for completion of existing project	55,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	40,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of—		Act of—	
July 4, 1836	$5,000	August 5, 1886	$10,000
March 3, 1837	5,000	August 11, 1888	9,000
March 3, 1871	10,000	September 19, 1890	25,000
June 10, 1872	10,000	July 13, 1892	15,000
March 3, 1873	10,000	August 18, 1894	15,000
June 23, 1874	10,000	June 3, 1896	15,000
March 3, 1875	25,000	March 3, 1899	20,000
August 14, 1876	14,000	June 13, 1902	30,000
June 18, 1878	6,000		
August 2, 1882	28,000	Total	290,000
July 5, 1884	28,000		

COMMERCIAL STATISTICS, 1901.

* * * * * * *

	Tons.
Coal	58,000
Bricks	40,000
Lumber	60,000
Cement, lime, and plaster	40,000
Phosphate	300
Wood	1,500
Ashes	75
Potatoes	15
Total	199,890

Arrivals and departures.

Vessels arriving	50
Tugs	100
Barges	190

B 5.

IMPROVEMENT OF EXETER RIVER, NEW HAMPSHIRE.

The approved project and the report of progress of the work to June 30, 1902, may be found in Part I, page 81, of this report.

There were no operations in progress during the past fiscal year, and the condition of the improvement is the same as on June 30, 1901.

The sum of $7,000, appropriated by the act of June 13, 1902, for the completion of the improvement, will be applied to that purpose in accordance with the general project.

* * * * * * *

Money statement.

July 1, 1901, balance unexpended	$96.97
Amount appropriated by river and harber act approved June 13, 1902	7,000.00
July 1, 1902, balance unexpended	7,096.97

APPROPRIATIONS.

Act of—	
June 14, 1880	$20,000
March 3, 1881	15,000
March 3, 1899	12,000
June 13, 1902	7,000
Total	54,000

COMMERCIAL STATISTICS, 1901.

* * * * * * *

	Tons.
Coal	11,750
Fish	200
Wood (cord)	1,800
Leather (scrap)	400
Total	14,150

Arrivals and departures.

Coastwise	137

During the year 30 two and three masted schooners of about 225 tons each, three 50-ton barges, and two 100-ton barges made about 100 trips up and down the river.

One river barge was built during the year.

B 6.

HARBOR OF REFUGE AT LITTLE HARBOR, NEW HAMPSHIRE.

The approved project and the report of progress of the work to June 30, 1902, may be found in Part I, page 81, of this report.

No operations were in progress during the past fiscal year, and the condition of the work is the same as on June 30, 1901.

* * * * * * *

Money statement.

July 1, 1901, balance unexpended	$295.82
Amount appropriated by river and harbor act approved June 13, 1902	13,000.00
July 1, 1902, balance unexpended	13,295.82

APPROPRIATIONS.

Act of—		Act of—	
August 5, 1886	$10,000	June 3, 1896	$10,000
August 11, 1888	20,000	March 3, 1899	12,000
September 19, 1890	40,000	June 13, 1902	13,000
July 13, 1892	30,000		
August 18, 1894	10,000	Total	145,000

COMMERCIAL STATISTICS.

The prospective benefits to commerce and navigation by the construction of this harbor of refuge are, primarily, increased safety to life and property, there being neither imports nor exports. During the calendar year 1901 the harbor was frequented by 290 vessels, as follows: Seventy-seven schooner yachts, 84 steam yachts, 75 sloop yachts, 37 fishing vessels, 11 tugboats, and 6 barges.

The average tonnage was 65; the average draft, 8 feet.

The following is an extract from statistics submitted by the superintendent of the First life-saving district:

"Captains of coastwise vessels are liberal in their expression of the value of this improvement as a harbor of refuge and aid to navigation, and express the hope that the good work will continue."

B 7.

IMPROVEMENT OF NEWBURYPORT HARBOR, MASSACHUSETTS.

The approved project and the report of progress of the work to June 30, 1902, may be found in Part I, page 82, of this report.

During the past fiscal year no operations were in progress other than the removal of North Rock and the resetting of the beacon on the end of the north jetty. With these exceptions, the condition of the improvement is the same as on June 30, 1901. North Rock was removed during July, 1901, at a total cost of $500. The beacon on the end of the north jetty, which was displaced some time ago by severe storms, was reset during June, 1902, and about 100 tons of heavy stone placed around it for its protection.

The sum of $30,000 was appropriated by the act of June 13, 1902, for continuing this improvement. It is proposed to apply this, together with the balance available of the old appropriation, toward the extension of the south jetty and to such repairs as may be necessary to both jetties.

The advantage to be derived from the completion of the project is the deepening and widening of the channel across the bar, thereby affording a harbor of refuge on the inside of Salisbury Beach and giving easy access at high tide to the wharves at Newburyport for vessels drawing 17 feet approximately.

* * * * * * *

Money statement.

July 1, 1901, balance unexpended	$3,459.71
Amount appropriated by river and harbor act approved June 13, 1902	30,000.00
	33,459.71
June 30, 1902, amount expended during fiscal year	514.08
July 1, 1902, balance unexpended	32,945.63
July 1, 1902, outstanding liabilities	160.00
July 1, 1902, balance available	32,785.63
Amount (estimated) required for completion of existing project	234,047.49
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	234,047.49

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATIONS.

Act of—		Act of—	
June 14, 1880	$50,000	July 13, 1892	$20,000
March 3, 1881	40,000	August 18, 1894	20,000
August 2, 1882	40,000	June 3, 1896	16,000
July 5, 1884	40,000	March 3, 1899	25,000
August 5, 1886	37,500	June 13, 1902	30,000
August 11, 1888	25,000		
September 19, 1890	25,000	Total	368,500

COMMERCIAL STATISTICS, 1901.

	Tons.
Coal	183,000

During the year 1901 there were 183 arrivals of vessels; total tonnage, 122,600. The vessels are barges and schooners, with an average draft of 12 feet and an average tonnage of 1,000.

One fishing steamer of about 28 tons and one four-masted schooner were built in the vicinity during the year.

During the fiscal year a new steamboat line was established between Haverhill, Newburyport, and Boston.

B 8.

IMPROVEMENT OF MERRIMAC RIVER, MASSACHUSETTS.

The approved project and report of progress of the work to June 30, 1902, may be found in Part I, page 84, of this report.

The river and harbor act of March 3, 1899, appropriated $40,000 for improvement of the river in accordance with the project submitted May 5, 1897. On July 5, 1899, a project was approved for the expenditure of this appropriation in dredging the channel to full proposed width and depth from Haverhill for as great a distance down the river as the funds would permit.

Contract for the work was let in 1899, but owing to the failure of the contractor to commence the dredging as required the contract was

annulled the following year and the work readvertised. During the past fiscal year the dredging was continued under contract with R. B. Rodermond. At the close of the fiscal year ending June 30, 1901, a total of 4,792 cubic yards had been removed, and during the past fiscal year 64,356 cubic yards of material were taken out, exclusive of 2.572 cubic yards of bowlders removed, which completed the 150-foot channel to full width and depth for a distance of about 1½ miles from Haverhill.

The river and harbor act of June 13, 1902, appropriated $40,000 for this work, which will be applied toward the extension of the improved channel down river for as great a distance as the available funds will permit.

Money statement.

July 1, 1901, balance unexpended	$38,570.58
Amount appropriated by river and harbor act approved June 13, 1902	40,000.00
	78,570.58
June 30, 1902, amount expended during fiscal year	27,687.87
July 1, 1902, balance unexpended	50,882.71
July 1, 1902, outstanding liabilities	7,830.06
July 1, 1902, balance available	43,052.65
July 1, 1902, amount covered by uncompleted contracts	2,970.00
Amount (estimated) required for completion of existing project	91,442.70
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	91,442.70
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of—		Act of—	
May 23, 1828	$32,100.00	March 3, 1879	$5,000.00
April 2, 1830	3,506.72	June 14, 1880	12,000.00
March 2, 1831	16,000.00	March 3, 1881	9,000.00
March 2, 1833	4,900.00	August 2, 1882	9,000.00
June 28, 1834	3,860 00	July 5, 1884	3,500.00
July 11, 1870	25,000.00	September 19, 1890	10,000.00
March 3, 1871	25,000.00	July 13, 1892	1,500.00
June 10, 1872	25,000.00	June 3, 1896	5,000.00
March 3, 1873	25,000.00	March 3, 1899	40,000.00
June 23, 1874	10,000.00	June 13, 1902	40,000.00
March 3, 1875	12,000.00		
June 18, 1878	10,000.00	Total	327,366.72

CONTRACT IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1902.

Contractor: R. B. Rodermond, New York, N. Y
Price per cubic yard:
For dredging, scow measurement, $0.495
For removing bowlders exceeding 3 tons in weight, $10.
Date of contract: September 15, 1900.
Date of approval: October 9, 1900.
Date of commencement: Twenty-one days after date of notification of approval of contract.
Date of completion: November 15, 1901.

COMMERCIAL STATISTICS.

The commerce involved in this improvement consists of supplies of coal, lumber, etc., for the cities and towns along its banks, the amount of coal reported in 1901 being 60,000 tons.

Arrivals and departures.

Schooners, tonnage 300, draft 12 feet	2
Barges, tonnage 2,100, draft 14 feet	3

The greater part of the coal is taken up in flat-bottomed scows.

During the fiscal year a new steamboat line was established between Haverhill, Newburyport, and Boston.

B 9.

IMPROVEMENT OF POWOW RIVER, MASSACHUSETTS.

The approved project and report of progress of the work to June 30, 1902, may be found in Part I, page 85, of this report.

No operations were in progress during the past fiscal year, and the condition of the improvement is the same as on June 30, 1901.

* * * * * * *

Money statement.

July 1, 1901, balance unexpended	$59.28
July 1, 1902, balance unexpended	59.28
Amount (estimated) required for completion of existing project	49,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	49,000.00

APPROPRIATIONS.

Act of—		Act of—	
August 11, 1888	$3,000	June 3, 1896	$12,000
September 19, 1890	5,000	March 3, 1899	12,000
July 13, 1892	4,000		
August 18, 1894	15,000	Total	51,000

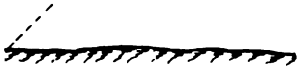
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B 10.

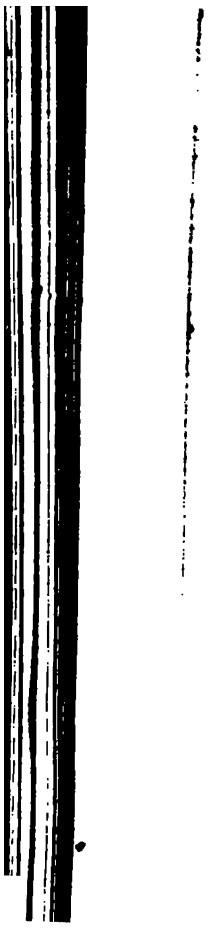
IMPROVEMENT OF HARBOR OF REFUGE AT SANDY BAY, CAPE ANN, MASSACHUSETTS.

The approved project and the report of progress of the work to June 30, 1902, may be found in Part I, page 85, of this report.

During the past fiscal year operations have been continued under the appropriation of $250,000 made by the river and harbor act of







March 3, 1899. A project for the expenditure of $110,000 of this appropriation in continuing construction of the substructure was approved July 14, 1899; and under date of March 21, 1901, a project was approved for the expenditure of the balance of the appropriation made by the act above referred to in completing the substructure of the southern arm and continuing the substructure of the western arm.

On June 30, 1901, the substructure of the southern arm was practically completed to mean low water, except for a distance of 70 feet, over which no work had been done, and a small section of the substructure of the western arm had been raised to mean low water. The balance of the western arm was completed for a distance of about 2,100 feet to 22 feet below mean low water, 40 feet wide on top.

During the past fiscal year a total of 113,202 tons of rubblestone was placed in the breakwater. A small part of this was placed in the southern arm to raise low places where the substructure had been beaten down by the sea. The greater part of the stone placed during the year, however, was applied to the extension of the western arm, which was raised to elevation (−12) for a distance of 400 feet from the angle at Abners ledge, and a core of the superstructure was built upon this 400-foot section up to mean high water, 12 feet wide on top.

The exact condition of the breakwater on June 30, 1902, is shown on accompanying plan.

The river and harbor act approved June 13, 1902, appropriated $200,000 for the continuation of this improvement and provided for the appointment of a Board of Engineers to examine into and report upon the project.

* * * * * * *

Money statement.

July 1, 1901, balance unexpended	$158,205.34
Amount appropriated by river and harbor act approved June 13, 1902	200,000.00
	358,205.34
June 30, 1902, amount expended during fiscal year	80,702.17
July 1, 1902, balance unexpended	277,503.17
July 1, 1902, outstanding liabilities	15,705.59
July 1, 1902, balance available	261,797.58
July 1, 1902, amount covered by uncompleted contracts	55,286.39
Amount (estimated) required for completion of existing project	3,650,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	500,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATIONS.

Act of—		Act of—	
July 5, 1884	$100,000	June 3, 1896	$150,000
August 5, 1886	100,000	March 3, 1899	250,000
August 11, 1888	100,000	June 13, 1902	200,000
September 19, 1890	150,000		
July 13, 1892	150,000	Total	1,350,000
August 18, 1894	150,000		

CONTRACT IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1902.

Contractors: Rockport, Pigeon Hill, and Cape Ann Granite Companies, Rockport, Mass.
Price per ton of 2,000 pounds: $0.607.
Date of contract: May 31, 1901.
Date of approval: June 14, 1901.
Date of commencement: July 1, 1901.
Date of completion: September 30, 1902.

COMMERCIAL STATISTICS.

The entire commerce of New England is directly interested in this improvement. Large shipments of stone are made from several little ports in the vicinity of Sandy Bay, and fish and supplies of coal, etc., are received at these ports, the total amounting annually to between 300,000 and 500,000 tons. While this shipping would be benefited by the harbor, these local statistics have no value as measuring the importance of the improvement.

B 11.

IMPROVEMENT OF HARBOR AT ROCKPORT, MASSACHUSETTS.

The location and a detailed description of this harbor may be found in Part I, page 87, of this report.

No work has been done on this harbor since 1847, when two breakwaters were built at the mouth of the harbor. Since that time these breakwaters have so far deteriorated that they fail to effect the purpose for which they were built.

The river and harbor act of June 13, 1902, appropriated $22,000 for completion of the improvement of the breakwaters and piers in accordance with report submitted in House Doc. No. 363, Fifty-sixth Congress, first session. The proposed improvement consists in rebuilding the breakwaters to a height of about 10 feet above high water with heavy rubblestone and in the removal of the principal rocks in the harbor. The project for doing the work has not yet been submitted.

* * * * * * *

Money statement.

Amount appropriated by river and harbor act approved June 13, 1902	$22,000.00
July 1, 1902, balance unexpended	22,000.00

APPROPRIATIONS.

Act of—		Act of—	
July 4, 1836	$10,000.00	March 3, 1847	$645.30
March 3, 1837	20,000.00	June 13, 1902	22,000.00
July 7, 1838	20,000.00		
February 13, 1845	18,437.27	Total	91,082.57

COMMERCIAL STATISTICS.

Arrivals and dapartures.

Eight hundred vessels, mostly fishermen, with a maximum tonnage of 60 and maximum draft of 11 feet.

Receipts and shipments.

	Tons.
Coal	2,500
Fish	1,700

B 12

IMPROVEMENT OF HARBOR AT GLOUCESTER, MASSACHUSETTS.

The approved project and the report of progress of the work to June 30, 1902, may be found in Part I, page 88, of this report.

No operations have been in progress during the past fiscal year, and the condition of the improvement is the same as on June 30, 1901.

The river and harbor act of June 13, 1902, placed this improvement under the continuous-contract system, appropriating $75,000 for the work and authorizing the Secretary of War to enter into such contracts as may be necessary to complete the project, to be paid for out of such appropriations as may from time to time be made by law, not to exceed in the aggregate $227,083. This act also provided that the existing project may be so modified that the breakwater now under construction shall terminate at Cat ledge, and that the remainder of the funds authorized to be expended by said act and not required for construction of the breakwater shall be applied toward the removal of "Round Rock," in Gloucester Harbor.

The project for the expenditure of the $75,000 appropriated by the act above referred to has not yet been submitted.

* * * * * * *

Money statement.

July 1, 1901, balance unexpended	$3,128.20
Amount appropriated by river and harbor act approved June 13, 1902	75,000.00
July 1, 1902, balance unexpended	78,128.20
Amount (estimated) required for completion of existing project	509,083.43
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	200,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of—		Act of—	
June 10, 1872	$10,000	June 3, 1896	$34,000
August 5, 1886	5,000	March 3, 1899	40,000
August 11, 1888	10,000	June 13, 1902	75,000
September 19, 1890	15,000		
July 13, 1892	40,000	Total	269,000
August 18, 1894	40,000		

COMMERCIAL STATISTICS.

The accompanying commercial statistics have been furnished by the collector of customs at Gloucester, Mass.

Amount of revenue collected.

* * * * * * *	
1901	$11,322

Shipping.

	1901.	
	Number.	Tons.
Entrances:		
Foreign	118	26,950
Domestic	37	2,540
Clearances:		
Foreign	115	18,900
Domestic	25	10,550

Receipts and shipments, 1901.

	Tons.
Coal	64,478
Salt	30,000
Lumber	3,686
Fish (fresh and salt)	70,000
Merchandise	80,000
Miscellaneous	3,000
Brick	6,600
Iron	3,500
Sand	200
Oil	1,200
Lime and cement	1,020
Total	263,684

During the calendar year 1901, 2,900 vessels were boarded by the United States revenue officials. About 75,000 passengers were carried to and from Gloucester by steamer. Forty-seven schooners and sloops, and four steamers, average tonnage about 130, were built in the vicinity during the year.

B 13.

IMPROVEMENT OF HARBOR AT MANCHESTER, MASSACHUSETTS.

The approved project and the report of progress of the work to June 30, 1902, may be found in Part I, page 90, of this report.

No operations have been in progress during the past fiscal year, and the condition of the improvement is the same as on June 30, 1901.

The river and harbor act approved June 13, 1902, appropriated $5,000 for the continuation of the dredging of this harbor. The project for the expenditure of this appropriation has not yet been submitted.

Money statement.

July 1, 1901, balance unexpended	$252.22
Amount appropriated by river and harbor act approved June 13, 1902	5,000.00
July 1, 1902, balance unexpended	5,252.22
Amount (estimated) required for completion of existing project	15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	15,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of—		Act of—	
August 11, 1888	$2,500	June 13, 1902	$5,000
September 19, 1890	5,000		
July 13, 1892	6,800	Total	24,300
March 3, 1899	5,000		

The first three appropriations were expended in execution of the project of November 28, 1887.

COMMERCIAL STATISTICS, 1901.

* * * * * * *

Coal	tons	5,800

A daily average of five yachts, small coasting and fishing vessels, frequent the harbor during seven months in the year.

B 14.

IMPROVEMENT OF BEVERLY HARBOR, MASSACHUSETTS.

The location and a detailed description of this harbor may be found in Part I, page 90, of this report.

This is a new work. From a survey made in 1900 it was found that the harbor has an available channel of 18 feet depth at mean low water to the wharves of the town, but that the channel was somewhat contracted at certain points.

By the river and harbor act of June 13, 1902, Congress adopted a project for widening the present channel in its narrow places so as to give a clear width of 200 feet, and appropriated $10,000 for doing the work. The project for the expenditure of these funds has not yet been submitted.

* * * * * * *

Money statement.

Amount appropriated by river and harbor act approved June 13, 1902	$10,000.00
July 1, 1902, balance unexpended	10,000.00

APPROPRIATION.

Act of June 13, 1902	$10,000.00

COMMERCIAL STATISTICS.

Receipts and shipments, 1901.

	Tons.
Coal	38,472
Cement	1,960
Lime	408
Sand	490
Lumber	6,048
Total	47,378

During the year 203 vessels arrived and 223 departed, the average tonnage being over 200 and the average draft about 15 feet. About 7 per cent of the vessels which enter Salem and Beverly harbors land their cargoes at Salem and Danversport by way of Beverly Harbor. Three gasoline propellers and two sailboats were built during the year.

B 15.

REPAIR OF SEA WALL AT MARBLEHEAD, MASSACHUSETTS.

A description of this work may be found in Part I, page 91, of this report.

Nothing has been done and no funds expended during the past fiscal year.

The river and harbor act of June 13, 1902, contains the following provision in regard to this work:

> The Secretary of War is hereby authorized and directed to cause a survey and an estimate of cost to be made of a breakwater upon the southerly side of the causeway leading from Marblehead to Marblehead Neck, with a view to protecting the said causeway, which forms one boundary of Marblehead Harbor, from destruction or injury by the sea, and to report to Congress the said estimate; and so much of the one thousand dollars as was appropriated for the repair of the sea wall at Marblehead in the act of March third, eighteen hundred and ninety-nine, as is unexpended and may be necessary, is hereby made available for the purposes of said survey and estimate.

This survey and estimate will be made and report submitted during the coming fall.

* * * * * * *

Money statement.

July 1, 1901, balance unexpended	$991.67
July 1, 1902, balance unexpended	991.67

APPROPRIATION.

Act of March 3, 1899	$1,000

B 16.

IMPROVEMENT OF HARBOR AT BURLINGTON, VERMONT.

The approved project and the report of progress of the work to June 30, 1902, may be found in Part I, page 91, of this report.

During the past fiscal year operations were continued upon the removal of the old timber and stone superstructure of the breakwater adjoining and south of the section rebuilt with stone in 1897. The old superstructure was removed for a farther distance of 237 feet and replaced with a superstructure of concrete. In addition to this, work was continued on making some repairs to the superstructure that were urgently needed where it had been seriously damaged by storms, about 180 feet being thus repaired with a facing of large concrete blocks.

The river and harbor act of June 13, 1902, appropriated $57,750 for the repair and maintenance of this breakwater, which it is proposed to apply to continuing the repair work and the replacement of the decayed superstructure with one of concrete. The project for the expenditure of the funds has not yet been submitted.

Money statement.

July 1, 1901, balance unexpended	$13,487.70
Amount appropriated by river and harbor act approved June 13, 1902	57,750.00
	71,237.70
June 30, 1902, amount expended during fiscal year	13,149.76
July 1, 1902, balance unexpended	58,087.94
Amount (estimated) required for completion of existing project	161,855.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	40,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATIONS.

Act of—		Act of—	
July 4, 1836	$10,000.00	June 18, 1878	$20,000.00
March 3, 1837	10,000.00	March 3, 1879	15,000.00
July 7, 1838	50,000.00	June 14, 1880	10,000.00
June 11, 1844	10,000.00	March 3, 1881	10,000.00
August 30, 1852	10,000.00	August 2, 1882	12,000.00
May 19, 1864	308.00	July 5, 1884	50,000.00
June 28, 1864	13,500.00	August 5, 1886	18,750.00
June 23, 1866	27,672.20	August 11, 1888	35,000.00
March 2, 1867	80,000.00	September 19, 1890	20,000.00
July 11, 1870	25,000.00	August 18, 1894	10,000.00
March 3, 1871	30,000.00	June 3, 1896	10,000.00
June 10, 1872	30,000.00	March 3, 1899	15,000.00
March 3, 1873	25,000.00	June 6, 1900	[a] 5,000.00
June 23, 1874	25,000.00	June 13, 1902	57,750.00
March 3, 1875	25,000.00		
August 14, 1876	20,000.00	Total	679,980.20

NOTE.—In 1872 $6,669.13 was carried to surplus fund and not expended.

CONTRACTS IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1902.

Name of contractor: William James Daly, Ogdensburg, N. Y.
Rate:
Removing old timber superstructure (about 465 linear feet), per linear foot, $8.
Concrete footing blocks, in place, per cubic yard, $8.50.
Concrete, in place, per cubic yard, $7.50.
Hemlock timber and plank, in place, per 1,000 feet B. M., $30.
Stone filling, in place, per cord of 128 cubic feet, $10.
Date of contract: October 26, 1899.
Date of approval: November 14, 1899.
Date of commencement: December 1, 1899.
Date of completion: October 31, 1900.[b]

Name of contractor: Daly & Hannan Dredging Co., Ogdensburg, N. Y
Rate:
Concrete blocks, per cubic yard, $8.
Portland cement, per barrel, $2.20 (Ironclad).
Broken stone, per ton of 2,000 pounds, $1.
Sand, per cubic yard, $0.75.
Cotton bags, each, $0.15.
Sharpening chisels and drills, each, $0.10.
Furnishing and operating plant, per day of 10 hours' work, $52.
Date of contract: August 20, 1901.
Date of commencement: Within five days after signature of contract.
Date of completion: On or before December 15, 1901.

[a] Allotment from emergency river and harbor act for repair work.
[b] Extended October 29, 1900, to October 31, 1901.

Supplemental.

Name of contractor: William James Daly, Ogdensburg, N. Y.
Rate:
Concrete in place, either in bulk or in bags, per cubic yard, $8.
Broken stone in place, per ton, $1.50.
Finishing and placing tie rods, of round iron, furnished by the United States, each, $3.50.
Placing flat tie rods removed from old work, each, $0.75.
Furnishing and placing flat tie-rods, each, $2.75.
Grouting joints on stone blocks, each, $0.50.
Plant consisting of 1 derrick scow, with steam power; 1 tug and 1 flat scow, with crews, fuel, and supplies, per day of ten hours' work, $52.
Date of contract: October 4, 1901.
Date of approval: October 18, 1901.
Date of commencement: Upon approval.
Date of completion: October 31, 1901.

COMMERCIAL STATISTICS.

Vessels employed in trade.

Class.	Number.	Registered tonnage.	Trips made.
Steam	19	15 to 1,150	1,432
Sail	25	42 to 100	123
Canal boats and barges	244	60 to 162	504

Greatest length, 196 feet, greatest draft, 10 feet.

Freight handled.

Articles.	1898.	1899.	1900.	1901.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Coal	43,352	39,236	76,762	55,985
Lumber and timber	36,702	23,334	21,003	19,128
Stone, gravel, and sand	11,281	8,249	11,298	14,645
General merchandise	25,192	16,811	22,163	18,476
Total	116,527	87,630	131,226	108,234

Passengers carried, 132,428.

B 17.

IMPROVEMENT OF OTTER CREEK, VERMONT.

The approved project and the report of progress of the work to June 30, 1902, may be found in Part I, page 93, of this report.

There were no operations in progress during the past fiscal year, and at the date of this report the condition of the improvement was the same as on June 30, 1901.

Money statement.

Amount (estimated) required for completion of existing project	$11,248.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	5,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of—		Act of—	
June 10, 1872	$10,000	September 19, 1890	$5,000
March 3, 1875	5,000	July 13, 1892	10,000
June 18, 1878	8,000	August 18, 1894	5,000
March 3, 1879	5,000	June 3, 1896	5,000
June 14, 1880	2,000	March 3, 1899	1,000
March 3, 1881	2,000		
August 2, 1882	2,000	Total	62,500
August 11, 1888	2,500		

COMMERCIAL STATISTICS.

Vessels engaged in trade.

Class.	Number.		Tonnage.	Draft.
	1900.	1901.		
				Feet.
Steam	5	2	18 to 240	5 to 8
Canal boats and barges	40	40	142 to 150	5 to 7

Freight handled.

Articles.	1897.	1899.	1900.	1901.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Coal	5,000	4,700	5,470	4,500
Lumber	1,080	600	600	560
Iron	1,050	900	1,000	300
Kaolin	300	500	520	300
General merchandise	250	500	500	100
Total	7,680	7,200	8,090	5,760

Number of passengers carried during calendar year ending December 31, 1901, 4,700.

B 18.

IMPROVEMENT OF HARBOR AT PLATTSBURG, NEW YORK.

The report of progress on the work of this harbor to June 30, 1902, may be found in Part I, page 93 , of this report.

The last project for the improvement of this harbor was completed in January, 1893, under the appropriation of $32,500 made by the act of September 19, 1890.

The river and harbor act of June 13, 1902, appropriated $5,000 for maintenance and restoration of this work. The project for the expenditure of these funds has not yet been submitted.

Money statement.

Amount appropriated by river and harbor act approved June 13, 1902	$5,000.00
July 1, 1902, balance unexpended	5,000.00

APPROPRIATIONS.

Act of—		Act of—	
July 4, 1836	$10,000.00	March 3, 1873	$10,000.00
March 3, 1837	10,000.00	June 23, 1874	5,000.00
July 7, 1838	27,500.00	March 3, 1879	2,000.00
March 3, 1843	2,680.01	June 14, 1880	1,000.00
June 11, 1844	10,000.00	August 5, 1886	5,000.00
May 19, 1864 (allotment)	2,000.00	August 11, 1888	7,000.00
March 2, 1867	26,000.00	September 19, 1890	[a]32,500.00
July 11, 1870	10,000.00	June 13, 1902	5,000.00
March 3, 1871	15,000.00		
June 10, 1872	10,000.00	Total	190,680.01

COMMERCIAL STATISTICS, 1895.

* * * * * * *

Freight handled.

Articles.	Shipped.	Arrived.
	Tons.	*Tons.*
Iron ore	985	
Potatoes	2,000	
Coal		20,636
Lumber	4,387	5,000
Iron	450	
General merchandise	7,400	5,537
Total	15,222	31,173

Vessels enrolled at Plattsburg Harbor, New York, December 31, 1895.

Number	354
Gross tonnage	35,906
Net tonnage	33,924

B 19.

IMPROVEMENT OF NARROWS OF LAKE CHAMPLAIN, NEW YORK AND VERMONT.

This improvement consists in widening and deepening the channel from Whitehall, N. Y., the northern terminus of the Champlain Canal, to Benson Landing, Vt., a distance of 15 miles.

The approved project and the report of progress of the work to June 30, 1902, may be found in Part I, page 94 of this report.

No operations have been in progress during the past fiscal year, owing to lack of funds, and the condition of the improvement is the same as on June 30, 1901.

The river and harbor act of June 13, 1902, appropriated $17,500 for this work, which will be applied to the completion of the improvement. The project for the expenditure of these funds has not yet been submitted.

[a] $239.25 returned to Treasury.

Money statement.

Amount appropriated by river and harbor act approved June 13, 1902	$17,500.00
July 1, 1902, balance unexpended	17,500.00

APPROPRIATIONS.

Act of—		Act of—	
August 5, 1886	$30,000	June 6, 1900	[a] $1,500
August 11, 1888	15,000	June 13, 1902	17,500
July 13, 1892	18,500		
March 3, 1899	5,000	Total	87,500

COMMERCIAL STATISTICS.

Amount of freight passing through the Narrows of Lake Champlain, 1901.

	Tons.
Timber and lumber	63,177
Pulp, wood	161,912
Salt	1,786
Sugar and molasses	537
Coal	203,753
Stone, lime, and clay	25,642
Iron ore	79,919
General merchandise	13,605
Total	550,331
Number of boats passing through the Narrows	5,281

B 20.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Wreck of schooner Index in harbor of Biddeford Pool, Me.—This was a schooner wrecked in the spring of 1893. The vessel was about 125 feet long and 28 feet wide, with a gross tonnage of 334.

The wreck was reported in the fall of 1901, and its removal was authorized November 12, 1901. Owing to bad weather and consequent delay, the removal was not completed until May, 1902.

The total cost of the work was $400.

[a] Allotment from emergency river and harbor act.



APPENDIX C.

IMPROVEMENT OF RIVERS AND HARBORS IN EASTERN MASSACHUSETTS SOUTH OF AND INCLUDING LYNN HARBOR.

REPORT OF LIEUT. COL. W. S. STANTON, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1902, WITH OTHER DOCUMENTS RELATING TO THE WORK.

IMPROVEMENTS.

1. Harbor at Lynn, Massachusetts.
2. Mystic and Malden rivers, Massachusetts.
3. Mystic River below the mouth of Island End River, Massachusetts.
4. Harbor at Boston, Massachusetts.
5. Town River, Massachusetts.
6. Weymouth River, Massachusetts.
7. Harbor at Cohasset, Massachusetts.
8. Harbor at Scituate, Massachusetts.
9. Harbor at Duxbury, Massachusetts.
10. Harbor at Plymouth, Massachusetts.
11. Harbor at Provincetown, Massachusetts.
12. Harbor at Chatham, Massachusetts.
13. Removing sunken vessels or craft obstructing or endangering navigation.

HARBOR LINES.

14. Mystic River at Somerville, Boston, Massachusetts.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., July 19, 1902.

GENERAL: I have the honor to transmit herewith annual reports for the works of river and harbor improvement in my charge for the fiscal year ended June 30, 1902.

Very respectfully, your obedient servant,

W. S. STANTON,
Lieut. Col., Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

C 1.

IMPROVEMENT OF HARBOR AT LYNN, MASSACHUSETTS.

No work was done upon this improvement during the fiscal year ended June 30, 1902.

June 27, 1902, the Chief of Engineers approved the project for expending $25,000, appropriated by the act of June 13, 1902, in dredging to the depth of 15 feet at mean low water the outer channel from the sea to the deep natural basin to the greatest width

(within 200 feet) that that amount of funds will obtain; and for expending $500 from the balance available from the project of 1884 in removing riprap in the upper channel, the remains of a former lighted beacon.

It is proposed to apply the appropriation recommended to extending the channel 15 feet deep at mean low water to the turning basin, part of the width prescribed in the project, and to dredging a part of the turning basin to that depth.

Money statements.

PROJECT OF 1884 FOR 10-FOOT CHANNEL.

July 1, 1901, balance unexpended	$6,875.26
June 30, 1902, amount expended during fiscal year	300.00
July 1, 1902, balance unexpended	6,575.26
Amount (estimated) required for completion of existing project	53,500.00

PROJECT OF 1900 FOR 15-FOOT CHANNEL.

Amount appropriated by river and harbor act approved June 13, 1902	$25,000.00
July 1, 1902, balance unexpended	25,000.00
Amount (estimated) required for completion of existing project	137,936.84
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	75,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

The dates and amounts of appropriations for this work are as follows:

Act of—		Act of—	
August 2, 1882	$60,000	August 18, 1894	$7,500
August 5, 1886	6,000	June 3, 1896	20,000
August 11, 1888	10,000	June 13, 1902	25,000
September 19, 1890	15,000		
July 13, 1892	10,000	Total	153,500

COMMERCIAL STATISTICS FOR THE FISCAL YEAR 1902.

[Through the courtesy of the collector of customs at Marblehead, Mass.]

Amount of revenue collected:

1902	$4,509.76

Shipping.

Vessels.	1902.	
	Number.	Tons.
Entrances:		
Foreign	24	2,375
Domestic	3,801	485,000
Clearances:		
Foreign	24	2,375
Domestic	3,801	485,000

Water Freight, 1902.

Coal	tons..	165,786
Iron	do....	373
Stone	cubic feet..	3,220
Laths	number..	17,000,000
Wood	cords..	580
Lumber	feet..	2,492,390
Lime and cement	barrels..	2,820
Brick	number..	130,000
Merchandise	tons..	160,000
Miscellaneous	do....	22,120

C 2.

IMPROVEMENT OF MYSTIC AND MALDEN RIVERS, MASSACHUSETTS.

No work has been done upon the improvement of these rivers during the fiscal year ended June 30, 1902.

The river and harbor act of June 13, 1902, appropriated $25,000 for "Improving Mystic and Malden rivers, and Mystic River below the mouth of Island End River, Mass."

MYSTIC RIVER.

June 28, 1902, it was recommended by letter to the Chief of Engineers that $1,000 of that appropriation be allotted to the improvement of Mystic River, and that that amount, together with the unallotted balance of $2,500 from the appropriation of $5,000 for "Improving Mystic and Malden rivers, Mass.," act of March 3, 1899, making $3,500, remain in the Treasury until the balance available becomes sufficient to complete the improvement to Medford, for which the aggregate amount required in accordance with the original estimate is $10,000.

MALDEN RIVER.

On June 28, 1902, it was recommended by letter to the Chief of Engineers that $5,000 of that appropriation be allotted to the improvement of the Malden River, to be applied to maintenance in redredging the channel to the depth of 12 feet in the localities where shoaling has occurred.

By letter of June 28, 1902, that part of the Malden River above the first bridge was reported unworthy of improvement.

It is proposed to apply the available balance and the additional appropriation recommended to the improvement of the Mystic River and to maintenance in the Malden River.

Money statement.

July 1, 1901, balance unexpended		$2,572.00
Amount appropriated by river and harbor act approved June 13, 1902		6,000.00
		8,572.00
June 30, 1902, amount expended during fiscal year		72.00
July 1, 1902, balance unexpended		8,500.00
Amount (estimated) required for completion of existing project		21,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902:		
For works of improvement	$6,500.00	
For maintenance of improvement	5,000.00	
		11,500.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

The dates and amounts of appropriations for these works are as follows:

For Malden River, by act of August 2, 1882	$10,000
For Mystic and Malden rivers, by act of July 13, 1892	10,000
For Mystic and Malden rivers, by act of August 18, 1894	10,000
For Mystic and Malden rivers, by act of June 3, 1896	10,000
For Mystic and Malden rivers, by act of March 3, 1899	5,000
For Malden River, by act of June 6, 1900	5,000
For Mystic River, by act of June 13, 1902	1,000
For Malden River, by act of June 13, 1902	5,000
Total	56,000

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1901.

[Furnished by wharf owners on the river.]

Mystic River.

	Tons.
Coal	16,800
Molasses	2,250

Malden River.

Coal	55,000
Molding sand	5,000
Steel, etc	1,600

C 3.

IMPROVEMENT OF MYSTIC RIVER BELOW THE MOUTH OF ISLAND END RIVER, MASSACHUSETTS.

No work has been done upon this improvement during the fiscal year ended June 30, 1902.

The river and harbor act of June 13, 1902, appropriated $25,000 for "Improving Mystic and Malden rivers, and Mystic River below the mouth of Island End River, Massachusetts."

June 28, 1902, it was recommended by letter to the Chief of Engineers that $19,000 of that appropriation be allotted to the improvement of Mystic River below the mouth of Island End River, and, together with the balance of appropriation made by act of March 3,

1899, be applied to dredging to 25 feet at mean low water the channel opposite the mouth of Island End River to the full width authorized by the project.

It is proposed to apply the available balance and the additional appropriation recommended in completing the channel up to the mouth of Island End River to the depth and width prescribed in the project.

Money statement.

July 1, 1901, balance unexpended	$2,486.88
Amount appropriated by river and harbor act approved June 13, 1902	19,000.00
	21,486.88
June 30, 1902, amount expended during fiscal year	200.00
July 1, 1902, balance unexpended	21,286.88
Amount (estimated) required for completion of existing project	198,547.50
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	133,547.50
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

The dates and amounts of appropriations for this work are as follows:

Act of—	
March 3, 1899	$50,000
June 13, 1902	19,000
Total	69,000

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1901.

[Furnished by wharf owners on the river.]

	Tons.
Coal	1,371,800
Lumber	50,000
Molasses	2,250
Molding sand	5,000
Steel, etc	1,600
Total	1,430,650

C 4.

IMPROVEMENT OF HARBOR AT BOSTON, MASSACHUSETTS.

MAIN SHIP CHANNEL.

Project of July 13, 1892.—To widen it to 1,000 feet and to deepen it to 27 feet at mean low water.

During the fiscal year ended June 30, 1902, 388,384.5 cubic yards, of clay mostly, have been dredged in the Upper Main Ship channel from the southerly half-channel width in a length of 3,400 feet at the Upper Middle. The dredging was under the contract of February 11, 1897, with Breymann Brothers, of Toledo, Ohio, and substantially completed the contract, some ridges, found in sweeping the channel,

only remaining to be removed. Under the contract of August 1, 1900, with Charles W. Johnston, of Lewes, Del., 246 cubic yards of slate ledge were removed from the northerly half of the channel at the Upper Middle to October 11, 1901, when the contract was completed. Under that contract from August 24, 1900, 3,446 cubic yards of slate ledge were removed, excavating to a least depth of 27 feet at mean low water several groups of ledges covering about 1 acre in the southerly half of the channel at the Upper Middle.

In sweeping that area, preceding final payment under the contract, 99 small areas or points of ledge were found bordering and interspersed between the excavated areas and which the soundings in a very close survey had not discovered. The highest was 1.4 feet above the level of 27 feet, and their entire volume down to 27 feet 6 inches was only 31 cubic yards. The contract with Johnston for the excavation of but a part of the ledge at the Upper Middle (as much as had to that time been uncovered) was made specially to clear one-half the channel width of ledges to the full depth of 27 feet and to make it available to navigation as soon as possible. As soon as a suitable plant could be obtained the removal of the 99 points of rock was commenced, November 13, 1901, continued under the very unfavorable conditions of midwinter, and was completed March 4, 1902, at a cost of $7,499.40, obtaining at the Upper Middle a clear channel width of 500 feet, 27 feet deep at mean low water. In the Lower Main Ship channel a small ledge, on account of its special location, was removed by the hired plant.

April 16 to June 14, 1902, the entire Upper Main Ship channel, 16,600 feet long and 1,000 feet wide, covering 377 acres, was swept at the depth of 27 feet to find any other points of rock not discovered by the soundings. Fifteen areas have been found which require examination, the depth on the highest of which is 25½ feet.

On June 30 the sweeping of the Lower Main Ship channel, 15,800 feet long and 1,000 feet wide, from President Roads to the sea, at the depth of 27 feet, was commenced and is in progress at this date.

To complete the Lower Main Ship channel, 1,000 feet wide, 27 feet deep, and 15,800 feet long, from President Roads to the sea at Nantasket Roads, a contract with G. H. Breymann & Bros., of Toledo, Ohio, was made April 30, 1902, and approved June 3, 1902, for excavating 19,008 cubic yards of ledge, to be commenced August 5, 1902, and to be completed December 31, 1903. The contract price is $9.73 per cubic yard.

To complete the Upper Main Ship channel, 16,600 feet long, from President Roads to Boston, to the width and depth aforesaid, ledges are to be removed near the entrance from President Roads, a group scattered over a distance of about 800 feet in the southerly half of the channel at the Upper Middle, and a ledge about 3,400 feet above the Upper Middle. At the localities of these ledges the channel, 27 feet deep, is narrowed, respectively, to 570, 500, and 670 feet in the Upper and to 450 feet in the Lower Main Ship channels.

The dredging being completed and the Upper Main Ship channel having been carefully swept to find all ledges upon which the depth is less than 27 feet, the ledges will at once be surveyed preparatory to their excavation.

BROAD SOUND CHANNEL.

Project of March 3, 1899.—To make it 1,200 feet wide and 30 feet deep at mean low water from President Roads to the sea.

During the fiscal year 380,844 cubic yards of mud, sand, gravel, and hardpan, and 14.754 cubic yards of bowlders weighing over 6 tons each, have been dredged under the contract of March 13, 1900, with G. H. Breymann & Bros., of Toledo, Ohio. June 30, 1902, the channel 30 feet deep had a least width of 780 feet.

The total quantity of material dredged from the Upper Main Ship and Broad Sound channels during the year amounts to 769,228.5 cubic yards of clay, hardpan, etc., and 73.68 cubic yards of large bowlders.

MAINTENANCE.

SEA WALLS.

At Point Allerton the sea wall, 1,202 feet in length, was entirely repointed, 30 capstones were reset, and a small amount of riprap protecting the bank of its southeast end was relaid.

At Great Brewster Island 2,496 linear feet of the sea wall, embracing 22,847 feet of joints, were repointed.

On Deer Island 556 linear feet of the wall at the Middle Head, which had been demolished by the storm of November, 1898, were rebuilt, embracing 1,558 cubic yards of masonry, 4,610 cubic yards of back filling, 1,040 square yards of paving, and 4,069 feet of old joints repointed.

The rebuilding of the wall at the North Head, a large part of which had been likewise demolished, was commenced in April, 1902, and 491 linear feet of it have been rebuilt, embracing 1,010 cubic yards of masonry, 1,100 cubic yards of back filling, 440 square yards of paving, and 2,345 feet of old joints have been repointed.

STOREHOUSE.

On Lovells Island a frame storehouse, 20 feet by 40 feet, was built for the care of property and for quarters for surveying parties.

TRIBUTARY CHANNELS.

Charles River.—The river and harbor act of September 19, 1890, appropriated—

> twenty thousand dollars for continuing improvement of Charles River: *Provided*, That no expenditure of said twenty thousand dollars shall be made until the draws in the Arsenal street and Market street bridges shall be made to conform to the projected channel without cost to the United States.

To June 7, 1884, the improvement was completed up to Arsenal Street Bridge, on which date the work was discontinued to await the alteration of the bridges to conform to the requirement in the above act. The improvement remaining to be made under the project is to extend the channel 80 feet wide and 6 feet deep 3,900 feet, to the Market Street Bridge, and from Market Street Bridge 8,725 feet, to the dam at Watertown, 60 feet wide and 2 feet deep.

The Arsenal Street Bridge has been altered to conform to the foregoing requirements, but the alteration has not been made in the Market Street Bridge, and no work has been done on the improvement during the fiscal year.

By provisos in the following acts of Congress amounts as follows have been appropriated for this improvement from appropriations for the improvement of Boston Harbor:

Act of—	
June 14, 1880	$22,500
March 3, 1881	35,000
September 19, 1890	20,000
Total	77,500
Amount not yet appropriated	47,500
Total estimated cost of existing project	125,000

There is available for this improvement $20,000, appropriated by the act of September 19, 1890, which amount is included in the "balance available, $136,337.13," shown in the money statement for "General Improvement, Boston Harbor."

Fort Point channel.—For the reason that funds are not available, no work has been done on this improvement during the fiscal year ended June 30, 1902.

There has been appropriated for this improvement, from appropriations for the improvement of Boston Harbor, by proviso in the—

Act of August 5, 1886	$18,750
Amount not yet appropriated	60,000
Total estimated cost of existing project	78,750

Chelsea Creek.—During the fiscal year ended June 30, 1902, under emergency contract with Bay State Dredging Company dated May 28, 1902, there were dredged, June 2 to 30, 1902, 13,255 cubic yards of mud, nearly completing a channel 75 feet wide and 18 feet deep at mean high water through the bar, and a channel 50 to 150 feet wide, 14 feet deep at mean high water, and 2,800 feet in length from the head of the 18-foot channel to Proctor's wharf, 500 feet below the head of navigation.

By provisos in the following acts of Congress amounts as follows have been appropriated for this improvement from the sums appropriated by those acts for the improvement of Boston Harbor:

Act of—	
June 3, 1896	$7,000
March 3, 1899	5,000
Total	12,000
Amount not yet appropriated	53,000
Total estimated cost of existing project	65,000

There is available for this improvement $1,449.65 appropriated by the act of March 3, 1899, which amount is included in the "balance available, $136,337.13," shown in the money statement for "General Improvement, Boston Harbor."

It is proposed to apply the available balance under the project of July 13, 1892, to improvement, in rock excavation to the depth of 27 feet at mean low water in the Upper and Lower Main Ship channels.

The available balance under the project of March 3, 1899, will be

applied to improvement, by dredging and some rock excavation to complete the channel 1,200 feet wide and 30 feet deep at mean low water from President Roads to Broad Sound.

The amount available and additional appropriation recommended under the project of June 13, 1902, to dredging to the depth of 35 feet at mean low water a channel from the navy-yard at Charlestown and the Chelsea Bridge and Charles River Bridge to President Roads and from President Roads to the ocean at Broad Sound, and to rock excavation.

It is proposed to apply the available balance and the additional appropriation recommended for the "General Improvement of Boston Harbor" to the repair of sea walls, to additional shore protection, and to the improvement of Fort Point channel and Chelsea Creek.

Money statements.

PROJECT FOR GENERAL IMPROVEMENT.

July 1, 1901, balance unexpended	$79,521.13
Amount appropriated by river and harbor act approved June 13, 1902	100,000.00
	179,521.13
June 30, 1902, amount expended during fiscal year	35,585.49
July 1, 1902, balance unexpended	143,935.64
July 1, 1902, outstanding liabilities	7,598.51
July 1, 1902, balance available	136,337.13
July 1, 1902, amount covered by uncompleted contracts	1,186.25
Amount (estimated) required for completion of existing project	147,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	100,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

PROJECT OF 1892.

July 1, 1901, balance unexpended	$356,055.40
Amount appropriated by sundry civil act approved June 28, 1902	175,000.00
	531,055.40
June 30, 1902, amount expended during fiscal year	90,767.19
July 1, 1902, balance unexpended	440,288.21
July 1, 1902, outstanding liabilities	61,836.31
July 1, 1902, balance available	378,451.90
July 1, 1902, amount covered by uncompleted contracts	187,911.32

PROJECT FOR BROAD SOUND CHANNEL.

July 1, 1901, balance unexpended	$405,625.03
June 30, 1902, amount expended during fiscal year	146,720.21
July 1, 1902, balance unexpended	258,904.82
July 1, 1902, outstanding liabilities	24,841.08
July 1, 1902, balance available	234,063.74
July 1, 1902, amount covered by uncompleted contracts	86,854.04

PROJECT OF 1900.

Amount appropriated by river and harbor act approved June 13, 1902.	$600,000.00
July 1, 1902, balance unexpended	600,000.00
Amount (estimated) required for completion of existing project	7,394,248.68
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	750,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

The dates and amounts of the appropriations for this work are as follows:

Act of—		Act of—	
March 2, 1825	$52,972.56	June 23, 1874	$100,000.00
March 19, 1828	2,000.00	March 3, 1875	100,000.00
May 23, 1828	87,000.00	August 14, 1876	50,000.00
March 2, 1829	7,310.54	June 18, 1878	55,000.00
March 2, 1831	5,000.00	March 3, 1879	50,000.00
March 2, 1831	12,390.00	June 14, 1880	75,000.00
February 24, 1832	9,000.00	March 3, 1881	100,000.00
July 3, 1832	60,000.00	August 2, 1882	96,500.00
July 4, 1836	15,000.00	July 5, 1884	5,000.00
July 7, 1838	7,353.00	August 5, 1886	56,250.00
March 3, 1841	1,000.00	August 11, 1888	125,000.00
March 3, 1841	1,500.00	September 19, 1890	145,000.00
August 31, 1842	2,000.00	July 13, 1892	300,000.00
March 3, 1843	16,000.00	August 18, 1894	200,000.00
July 20, 1848	40,000.00	June 3, 1896	70,000.00
August 30, 1852	30,000.00	June 4, 1897 [a]	400,000.00
July 2, 1864	40,000.00	July 1, 1898 [a]	250,000.00
July 2, 1864	10,000.00	March 3, 1899	75,000.00
February 28, 1865	3,000.00	March 3, 1899 [a]	163,751.00
February 28, 1865	20,000.00	June 6, 1900 [a]	317,000.00
June 12, 1866	50,000.00	March 3, 1901 [a]	133,000.00
July 12, 1866	75,000.00	June 13, 1902	100,000.00
March 2, 1867	375,000.00	June 13, 1902	600,000.00
July 11, 1870	100,000.00	June 28, 1902 [a]	175,000.00
March 3, 1871	100,000.00		
June 10, 1872	75,000.00	Total	5,088,027.10
March 3, 1873	150,000.00		

LIST OF CONTRACTS IN FORCE JUNE 30, 1902.

Contract dated February 11, 1897: Breymann Bros., of Toledo, Ohio, contractors, to dredge 2,910,718 cubic yards, more or less, of material from the main ship channel, Boston Harbor, Massachusetts, at 17½ cents per cubic yard; approved March 9, 1897; to be commenced April 1, 1897; to be completed June 30, 1900; time of completion extended to October 30, 1902, on February 27, 1900.

Contract dated March 13, 1900: G. H. Breymann & Bros., of Toledo, Ohio, contractors, to dredge 836,082 cubic yards, more or less, of material from Broad Sound channel, Boston Harbor, Massachusetts, at 35 cents per cubic yard, approved March 31, 1900; to be commenced July 1, 1900; to be completed June 30, 1902; time for completion waived for a reasonable period.

Contract dated April 30, 1902: G. H. Breymann & Bros., of Toledo, Ohio, contractors, to excavate 19,008 cubic yards, more or less, of ledge in the lower main ship channel, Boston Harbor, Massachusetts, at $9.73 per cubic yard situ measurement; approved June 3, 1902; to be commenced August 5, 1902, to be completed December 31, 1903.

Emergency contract dated May 28, 1902: Bay State Dredging Company, of Boston, Mass., contractor, to dredge 18,000 cubic yards, more or less, of material from Chelsea Creek, Boston Harbor, Massachusetts, at 25 cents per cubic yard; to be commenced June 7, 1902, and to be completed August 28, 1902.

[a] Sundry civil act.

COMMERCIAL STATISTICS FOR THE FISCAL YEAR 1902.

[Through the courtesy of the collector of customs at Boston, Mass.]

Amount of revenue collected:
1902 $21,067,705.54

Entrances and clearances.

	1902.	
	Number.	Tons.
Entrances:		
Foreign	1,549	2,199,597
Domestic	209	193,446
Clearances:		
Foreign	1,403	2,860,561
Domestic	266	204,751

IMPORTS AND EXPORTS, 1902.

Imports.

Merchandise	$71,920,425
Coin and bullion	99,358

Exports.

Foreign:	
Merchandise	645,129
Domestic:	
Merchandise	101,759,145
Coin and bullion	9,000

Vessels engaged in the coastwise trade are not required by law to enter and clear from the custom-house unless they have in their cargoes bonded merchandise to the value of $350 or more. For this reason the above records of the custom-house as regards domestic commerce represent but a fractional part of the actual domestic commerce of the port.

From the Boston Chamber of Commerce has been obtained the following record of—

Domestic commerce.

	Calendar year 1901.	
	Number.	Aggregate gross tonnage.
Arrivals	10,415	8,724,118
Departures	10,415	8,724,118

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1901.

Charles River.

[Furnished by wharf owners on the river.]

Coal	tons..	99,008
Lumber	feet..	5,000,000
Wood	cords..	250
Lime	barrels..	3,500

Port Point Channel.

[Furnished by wharf owners of the channel.]

Coal	tons..	145,000
Sugar	do....	134,815
Molasses	do....	23,192
Building material	do....	10,386

Chelsea Creek.

[Furnished by George F. Proctor & Co.]

Coal	tons..	12,000

C 5.

IMPROVEMENT OF TOWN RIVER, MASSACHUSETTS.

For the reason that sufficient funds were not available, no work was done upon this improvement during the fiscal year ended June 30, 1902.

It is proposed to apply the available balance and the additional appropriation recommended in completing the project and maintaining the improvement.

Money statement.

July 1, 1901, balance unexpended	$268.49
Amount appropriated by river and harbor act approved June 13, 1902	9,750.00
	10,018.49
June 30, 1902, amount expended during fiscal year	23.41
July 1, 1902, balance unexpended	9,995.08
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902, for maintenance of improvement	5,000.00

Submitted in compliance with requirements, of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

The dates and amounts of the appropriations for this work are as follows:

Act of—	
June 3, 1896	$10,000.00
March 3, 1899	8,000.00
June 13, 1902[a]	9,750.00
Total	27,750.00

COMMERCIAL STATISTICS FOR THE FISCAL YEAR 1902.

[Furnished by wharf owners on the river.]

Coal	tons..	2,000
Lumber	feet..	4,000,000
Stone	tons..	90,000

[a] Allotment requested from appropriation of $15,000, for "Improving Weymouth and Town Rivers, Massachusetts."

C 6.

IMPROVEMENT OF WEYMOUTH RIVER, MASSACHUSETTS.

For the reason that sufficient funds were not available no work was done upon this improvement during the fiscal year ended June 30, 1902.

It is proposed to apply the available balance and the additional appropriation recommended in completing the project and maintaining the improvement.

Money statement.

July 1, 1901, balance unexpended	$923.40
Amount appropriated by river and harbor act approved June 13, 1902	5,250.00
July 1, 1902, balance unexpended	6,173.40
Amount (estimated) required for completion of existing project	12,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902:	
For works of improvement	$12,000.00
For maintenance of improvement	2,500.00
	14,500.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

The dates and amounts of the appropriations for this work are as follows:

Act of—	
September 19, 1890	$10,000
July 13, 1892	10,000
August 18, 1894	5,000
June 3, 1896	15,000
March 3, 1899	10,000
June 13, 1902	5,250
Total	55,250

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1901.

[Furnished by wharf owners on the river.]

Coal	tons	38,000
Lumber	feet	3,800,000
Laths	number	1,400,000
Shingles	do	1,831,000
Brick	do	600,000
Lime	barrels	3,200
Sand	tons	154

Weymouth Back River for the calendar year 1901.

[Furnished by wharf owners on the river.]

Coal	tons	5,000
Raw and manufactured fertilizer products	do	95,000

C 7.

IMPROVEMENT OF HARBOR AT COHASSET, MASSACHUSETTS.

On June 26, 1902, a project was submitted for the expenditure of $9,000 from the appropriation of $10,000 made by act of June 13, 1902, in dredging a channel from the roadstead to the channel in the harbor 4 feet at mean low water, 60 feet wide, increasing to 75 feet in width at the curve, in accordance with the project.

It is proposed to apply the additional appropriation recommended to widening the natural channel in the harbor to 60 feet, to dredging the turning basin 350 feet by 350 feet, and to extending the channel along the wharfs about 530 feet beyond the turning basin, as prescribed in the project, all to the depth of 4 feet at mean low water.

Money statement.

Amount appropriated by river and harbor act approved June 13, 1902	$10,000.00
July 1, 1902, balance unexpended	10,000.00
Amount (estimated) required for completion of existing project	11,670.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	11,670.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

The date and amount of appropriation for this harbor is as follows:

Act of June 13, 1902	$10,000

COMMERCIAL STATISTICS FOR THE FISCAL YEAR 1902.

[Furnished by Tower Bros. & Co., Cohasset, Mass.]

	Tons.
Coal	2,000
Lumber	670
Brick	500

C 8.

IMPROVEMENT OF HARBOR AT SCITUATE, MASSACHUSETTS.

During the fiscal year ended June 30, 1902, in the maintenance of the channel between the basin and the town wharves, 2,887 cubic yards of gravel and beach shingle were dredged, increasing the width of the channel to 110 feet (from 75 feet) with a depth of 3 feet at mean low water.

It is proposed to apply the available balance and the additional appropriation recommended to maintenance in restoring the present north breakwater to its former height, and in dredging.

Money statement.

July 1, 1901, balance unexpended	$1,892.74
June 30, 1902, amount expended during fiscal year	1,744.68
July 1, 1902, balance unexpended	148.06
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902, for maintenance of improvement	7,500.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

The dates and amounts of the appropriations for this work are as follows:

Act of—		Act of—	
March 2, 1829	$180	September 19, 1890	$10,000
August 30, 1852	1,000	July 13, 1892	10,000
June 14, 1880	7,500	August 18, 1894	10,000
March 3, 1881	10,000	June 3, 1896	6,000
August 2, 1882	10,000	March 3, 1899	15,000
July 5, 1884	10,000		
August 5, 1886	10,000	Total	104,680
August 11, 1888	5,000		

COMMERCIAL STATISTICS FOR THE FISCAL YEAR 1902.

[Through the courtesy of the collector of customs at Plymouth, Mass.]

Amount of revenue collected:

1902	$865.77

Entrances, 1902.

Entrances:	
Foreign	8
Domestic	20

Freight, 1902.

Coal	tons	4,200
Lumber	feet	3,500,000
Lime and cement	barrels	2,000
Brick	number	800,000

C 9.

IMPROVEMENT OF HARBOR AT DUXBURY, MASSACHUSETTS.

For want of funds no work has been done upon this improvement during the fiscal year ended June 30, 1902.

It is proposed to apply the additional appropriation recommended to increasing the width the entire length of the channel to the width authorized by the project and to maintenance.

Money statement.

July 1, 1901, balance unexpended	$96.26
June 30, 1902, amount expended during fiscal year	96.26
Amount (estimated) required for completion of existing project	5,820.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	5,820.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

The dates and amounts of appropriations for this harbor are as follows:

Act of—	
July 4, 1836	$5,000
June 10, 1872	10,000
March 3, 1873	10,000
March 3, 1899	12,000
Total	37,000

COMMERCIAL STATISTICS FOR THE FISCAL YEAR 1902.

[Through the courtesy of the collector of customs at Plymouth, Mass.]

Domestic shipping.

	1901.	1902.
Entrances	7	7
Clearances	7	7

Freight.

Articles.	1901.	1902.
Coal, tons	1,309	955
Lumber, feet	276,000	458,632

C 10.

IMPROVEMENT OF HARBOR AT PLYMOUTH, MASSACHUSETTS.

During the fiscal year ended June 30, 1902, under the contract of May 16, 1901, with the Rockport Granite Company, 6,526.5 linear feet of rubblestone dike, containing 13,728 tons of stone, were built, completing a dike 10,468 feet in length, containing 28,600 tons of stone, on Long Beach, Plymouth Harbor, which has resulted in strengthening the beach by the accretion of a large volume of sand and beach shingle.

It is proposed to apply the available balance and the amount recommended to be appropriated to maintenance in redredging the channel and basin to and at the wharf dredged under the project of March 3, 1875, as modified.

Money statement.

July 1, 1901, balance unexpended	$51,153.56
Amount appropriated by river and harbor act approved June 13, 1902	4,000.00
	55,153.56
June 30, 1902, amount expended during fiscal year	32,353.73
July 1, 1902, balance unexpended	22,799.83
Amount (estimated) required for completion of existing project	20,700.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902, for maintenance of improvement	5,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

The dates and amounts of appropriations for this harbor are as follows:

Act of—		Act of—	
May 26, 1824	$20,000.00	June 18, 1878	$5,000.00
March 3, 1825	5,712.00	March 3, 1879	3,500.00
March 25, 1826	13,184.90	June 14, 1880	10,000.00
April 23, 1830	1,850.00	March 3, 1881	10,000.00
March 2, 1831	2,820.00	August 2, 1882	14,000.00
July 3, 1832	2,500.00	July 5, 1884	10,000.00
March 2, 1833	600.00	August 5, 1886	6,000.00
June 28, 1834	2,000.00	August 11, 1888	6,000.00
March 3, 1835	700.00	September 19, 1890	8,000.00
July 2, 1836	500.00	July 13, 1892	9,500.00
July 7, 1838	2,400.00	August 18, 1894	1,500.00
August 31, 1852	5,000.00	June 3, 1896	1,500.00
July 11, 1870	10,000.00	March 3, 1899	10,000.00
March 3, 1871	10,000.00		75,000.00
June 10, 1872	2,500.00	June 13, 1902[a]	4,000.00
March 3, 1873	3,000.00		
June 23, 1874	5,000.00	Total	271,766.90
March 3, 1875	10,000.00		

COMMERCIAL STATISTICS FOR THE FISCAL YEAR 1902.

[Through the courtesy of the collector of customs at Plymouth, Mass.]

Amount of revenue collected:	
1902	$947.67

Entrances and clearances, 1902.

Entrances:	
Foreign	5
Domestic	67
Clearances:	
Foreign	7
Domestic	67

Freight.

Coal	tons	29,023
Lumber	feet	3,080,000

[a] Allotment requested from appropriation of $15,000 for "Improving Harbors at Plymouth and Provincetown, Massachusetts."

C 11.

IMPROVEMENT OF HARBOR AT PROVINCETOWN, MASSACHUSETTS.

All work during the fiscal year has been on the beach between the sea and House Point Island flats, which are overflowed by the waters of the harbor. There, for a length of 2,800 feet, extending southeasterly from Abel Hill dike, the beach and sand dunes along its crest were severely eroded by the sea in several northwesterly storms between November, 1901, and March, 1902, in which time the high water line advanced into the beach and sand dunes 10 to 25 or 30 feet.

Along the 2,800 feet of beach where this erosion occurred there were built between December, 1901, and the close of the fiscal year, June 30, 1902, 314 feet of dike, consisting of plank and timber bulkheads retaining a filling of sand; 737 linear feet of single bulkhead; 2,100 linear feet of groins of light lattice work, and 9,486 linear feet of low sand-catching fences.

Along the 540 feet next to the dike this work prevented the waves from breaching the beach and the opening of a way for the sea across it into the waters of the harbor on the flats. The groins have materially promoted the accretion of the beach, which, it is hoped, may be continued by watchfulness and by frequent and moderate expenditures. A fund of not less than $5,000 should be always available for emergencies.

It is proposed to apply the available balance to the building of groins and sand-catching fences to promote the accretion of the beach, and the building of dikes to prevent any breaches that may be threatened in the beach.

Money statement.

July 1, 1901, balance unexpended	$10,031.87
Amount appropriated by river and harbor act approved June 13, 1902	11,000.00
	21,031.87
June 30, 1902, amount expended during fiscal year	4,143.85
July 1, 1902, balance unexpended	16,888.02

The dates and amounts of the appropriations for this work are as follows:

Act of—		Act of—	
May 19, 1826	$3,500.00	June 18, 1878	$1,000.00
March 2, 1829	3,500.00	March 3, 1879	1,000.00
March 2, 1831	2,050.00	June 14, 1880	500.00
March 3, 1832	4,600.00	March 3, 1881	5,000.00
June 28, 1834	4,400.00	August 2, 1882	5,000.00
March 3, 1835	4,400.00	July 5, 1884	2,000.00
July 2, 1836	4,400.00	August 5, 1886	3,000.00
July 7, 1838	4,500.00	August 11, 1888	3,000.00
August 30, 1852	5,000.00	September 19, 1890	7,500.00
June 23, 1866	43,068.44	July 13, 1892	1,500.00
July 28, 1866	8,000.00	August 18, 1894	1,500.00
March 3, 1871	6,000.00	June 3, 1896	1,500.00
June 10, 1872	5,000.00	March 3, 1899	10,000.00
March 3, 1873	6,000.00	June 13, 1902[a]	11,000.00
June 23, 1874	6,000.00		
March 3, 1875	5,000.00	Total	176,918.44
August 14, 1876	4,000.00		

[a] Allotment requested from appropriation of $15,000 for "Improving Harbors at Plymouth and Provincetown, Mass."

COMMERCIAL STATISTICS FOR THE FISCAL YEAR 1902.

[Through the courtesy of the collector of customs, Barnstable, Mass.]

Amount of revenue collected:

1902 $215.65

Entrances and clearances.

	Number.	Tons.
Entrances:		
Foreign	17	3,400
Domestic	13	1,000
Clearances:		
Foreign	8	1,600
Domestic	4	600

Freight, 1902.

Coal	tons..	7,000
Iron	do....	1,500
Salt	do....	700
Lumber	feet..	1,500,000
Lime and cement	barrels..	1,000
Brick	number..	2,000,000
Merchandise	tons..	3,000
Miscellaneous	do....	1,000

C 12.

IMPROVEMENT OF HARBOR AT CHATHAM, MASSACHUSETTS.

The scope of the improvement is to obtain channels 6 feet deep, 200 feet wide through the outer bar, 150 feet wide through the middle bar, and 100 feet wide through the inner bar, all embraced in the 1½ miles of channel next to its entrance from Chatham Roads.

In 1891 the channel through the inner bar was completed and the channel through the middle bar dredged to the partial width of 100 feet.

During the fiscal year ended June 30, 1902, 16,599 cubic yards of sand were dredged from the three bars, commencing and completing the improvement of the channel through the outer bar to the full width of 150 feet, completing the channel through the inner bar to the full width of 100 feet, and restoring to the depth of 6 feet at mean low water the channel dredged through the inner and middle bars in 1891. Of this dredging 6,858.5 cubic yards were for improvement and 9,740.5 cubic yards for maintenance.

The dredging was all done under the contract of August 30, 1900, with R. B. Rodermond, of New York City, which was commenced July 3, 1901, and completed November 9, 1901.

At its close the channels through the bars were 6 feet deep at mean low water, 200 feet wide through the outer, 150 feet wide through the middle, and 100 feet wide through the inner bars, as required by the project, and, respectively, 900, 500, and 550 feet long.

The project is completed.

The three bars are in a very tortuous part of the channel in the shoals of sand bordering Chatham Roads, and repeated redredging will be necessary to maintain the channels through them.

Money statement.

July 1, 1901, balance unexpended	$8,179.86
June 30, 1902, amount expended during fiscal year	6,618.43
July 1, 1902, balance unexpended	1,561.43

The dates and amounts of appropriations for this harbor are as follows:

Act of—	
September 19, 1890	$5,000.00
June 3, 1896	5,000.00
March 3, 1899	3,732.79
Total	13,732.79

COMMERCIAL STATISTICS FOR THE FISCAL YEAR 1902.

[Through the courtesy of the collector of customs, Barnstable, Mass.]

Freight.

Coal	tons..	1,200
Lumber	feet..	300,000
Merchandise	tons..	4,500

C 13.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

July 27, 1901, it was reported that parts of the hull of schooners *Ira Laffrinier* and *Mondego* were obstructions to navigation in Nauset Harbor, Massachusetts, and under an allotment of $750, made by the Secretary of War on July 31, 1901, from the indefinite appropriation made by section 20 of the river and harbor act of March 3, 1899, fragments of the two schooners were removed in September, 1901, under informal contract with Charles F. Ward, of Chatham, Mass., at a cost of $373.18, the total cost, including $8.53 for examination, being $381.71.

June 4, 1902, an allotment of $100 from the same appropriation was made to investigate further wreckage in Nauset Harbor complained of as obstructing navigation, and at the date of this report the examination is about to be made.

C 14.

MODIFICATION OF HARBOR LINES IN MYSTIC RIVER AT SOMERVILLE, BOSTON, MASSACHUSETTS.

BOSTON AND MAINE RAILROAD,
PRESIDENT'S OFFICE,
Boston, May 1, 1902.

Respectfully represents the Boston and Maine Railroad that it has been granted by the Board of Harbor and Land Commissioners of the Commonwealth of Massachusetts a license to fill solid and build a pile platform in Mystic River, between the Boston and Maine Railroad, Western Division, bridge and the easterly side line of the Middlesex Fells parkway, in the city of Somerville, Mass., in accordance with license No. 2612,[a] granted by said board, dated April 25, 1902, and license plan No. 2612,[a] whereby is authorized the dredging of material for said solid fill from said Mystic River opposite its said lands known as the "dirty marshes," giving a greater depth of water and improved facilities for navigation and commerce.

Wherefore your petitioner respectfully asks for authority to do said work in accordance with said license and plan. A copy of said license and three copies of said license plan are herewith submitted.

BOSTON AND MAINE RAILROAD,
By LUCIUS TUTTLE, *President.*

Honorable SECRETARY OF WAR.

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
May 23, 1902.

Respectfully returned to the Secretary of War.

The Boston and Maine Railroad Company requests permission to fill flats and build a pile platform in Mystic River, in the city of Somerville, between the Boston and Maine Railroad bridge, western division, and the easterly side line of the Middlesex Fells Parkway at Middlesex Avenue Bridge, in conformity with the accompanying plan,[a] which has received the approval of the harbor and land commissioners of the State of Massachusetts.

This request appears to be in effect the same as that made by the mayor of Somerville, February 3, 1902, for a change of harbor line in the locality, which request was not favorably considered by the Secretary of War for the reason that it had not received the approval of the harbor and land commissioners of the State of Massachusetts.

The subject has been under consideration of Lieut. Col. W. S. Stanton, Corps of Engineers, to whose report[a] of the 21st instant attention is respectfully invited. As the work proposed by the Boston and Maine Railroad Company has received the approval of the harbor and land commissioners, and as the granting of permission to execute this

[a] Not printed.

work would practically have the same effect as the modification of the harbor line, I am of the opinion that it would be preferable to modify the harbor line.

I accordingly submit herewith a description of a new bulkhead and pierhead line, which will conform to the line requested by the mayor of Somerville, and also a map on which said line is delineated. Should this line be approved by the Secretary of War the railroad company will be enabled to carry out the work of building a pile platform and filling solid behind it without further permission from the Department.

Approval of the line is recommended.

* * * * * * *

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Fifth indorsement.]

WAR DEPARTMENT, *May 29, 1902.*

Approved as recommended by the Chief of Engineers.

WM. CARY SANGER,
Assistant Secretary of War.

DESCRIPTION OF PROPOSED HARBOR LINE ON THE SOUTH SIDE OF MYSTIC RIVER, ON THE LINE OF THE BOSTON AND MAINE RAILROAD.

South side of Mystic River, above the Boston and Maine Railroad bridge—bulkhead and pier-head lines.

The bulkhead and pier-head lines are coincident, and are described as follows:

Beginning at the northeasterly corner of the south abutment of the Boston and Maine Railroad bridge, which point is identical with the point fixed by harbor lines approved by the Secretary of War June 20, 1890, and point A upon the plan attached to license No. 2035, granted July 25, 1897, by the Board of Harbor and Land Commissioners of the Commonwealth of Massachusetts to the Boston and Maine Railroad to fill flats and build pile platform in Mystic River, and approved by the Secretary of War August 30, 1897; thence running northwesterly in a straight line to a point in the westerly side of the Middlesex Avenue Bridge, 246.5 feet northerly from the northwesterly corner of the south abutment thereof; thence continuing by the same straight line to a point in the westerly side line of the Middlesex Fells parkway, 533.5 feet northeasterly from the stone post in the angle and said side line of said parkway; thence continuing farther in the same straight line 468 feet to the point of tangency with a curve of 510 feet radius; thence continuing by said curve 48° 55′, more or less, to its point of tangency with a straight line drawn through a point in the southerly line of Mystic avenue, Somerville, 1,460 feet westerly of the southwest corner of Mystic avenue and Taylor street; thence running from said second point of tangency by said second tangent line a distance of 975 feet, more or less, to a point 400 feet northeasterly from the intersection of said second tangent line with the said southerly side of said Mystic avenue; thence turning an angle of 25° 30′ and running westerly by a straight line to its intersection with the northerly line of Mystic avenue at the point X on the plan approved by the Secretary of War June 20, 1890.

APPENDIX D.

IMPROVEMENT OF RIVERS AND HARBORS IN SOUTHEASTERN MASSACHUSETTS AND IN RHODE ISLAND.

REPORT OF MAJ. G. W. GOETHALS, CORPS OF ENGINEERS, OFFICER IN CHARGE FOR THE FISCAL YEAR ENDING JUNE 30, 1902, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Harbor of Refuge at Hyannis, Massachusetts.
2. Harbor of Refuge at Nantucket, Massachusetts.
3. Vineyard Haven Harbor, Massachusetts.
4. Woods Hole Channel, Massachusetts.
5. New Bedford Harbor, Massachusetts.
6. Taunton River, Massachusetts.
7. Sakonnet River, Rhode Island.
8. Pawtucket (Seekonk) River, Rhode Island.
9. Providence River and Narragansett Bay, Rhode Island.
10. Green Jacket Shoal, Providence River, Rhode Island.
11. Fall River Harbor, Massachusetts.
12. Newport Harbor, Rhode Island.
13. Harbor of Refuge at Point Judith, Rhode Island.
14. Entrance to Point Judith Pond, Rhode Island.
15. Harbor of Refuge at Block Island, Rhode Island.
16. Great Salt Pond, Block Island, Rhode Island.
17. Removing sunken vessels or craft obstructing or endangering navigation.

HARBOR LINES.

18. Newport Harbor, Rhode Island.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., July 19, 1902.

GENERAL: I have the honor to transmit herewith annual report on river and harbor work under my charge during fiscal year ending June 30, 1902.

First Lieut. R. P. Johnston was on duty under the direction of this office from the beginning of the fiscal year until relieved July 29, 1901.

Very respectfully, your obedient servant,

GEO. W. GOETHALS,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

D 1.

HARBOR OF REFUGE AT HYANNIS, MASSACHUSETTS.

The harbor of Hyannis lies on the south shore of the peninsula of Cape Cod, about 15 miles to the westward of the heel of the cape, and is an important harbor of refuge. (For map, see Annual Report of the Chief of Engineers for 1884, p. 592.)

Operations during the past fiscal year.—No operations have been in progress during the past fiscal year. Contingent expenses were 89 cents.

Operations contemplated for the fiscal year ending June 30, 1903.—The available funds will be applied to carrying out the present project.

Money statement.

July 1, 1901, balance unexpended	$1,862.00
Amount appropriated by river and harbor act approved June 13, 1902	20,000.00
	21,862.00
June 30, 1902, amount expended during fiscal year	.89
July 1, 1902, balance unexpended	21,861.11
Amount (estimated) required for completion of existing project	12,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	12,500.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

Previous projects.

March 2, 1827	$10,650.00	
April 30, 1830	6,517.82	
March 2, 1831	8,400.00	
July 3, 1832	7,600.00	
March 2, 1833	5,000.00	
June 28, 1834	10,000.00	
March 3, 1835	9,000.00	
March 3, 1837	5,000.00	
July 7, 1838	8,764.00	
August 30, 1852	5,000.00	
July 11, 1870	12,000.00	
March 3, 1871	10,000.00	
March 3, 1873	10,000.00	
June 23, 1874	5,000.00	
June 18, 1878	3,000.00	
March 3, 1879	2,500.00	
March 3 1881	5,000.00	
		$123,431.82

Existing project.

August 5, 1886	$10,000.00	
August 11, 1888	10,000.00	
September 19, 1890	8,000.00	
July 13, 1892	6,000.00	
August 18, 1894	3,500.00	
June 3, 1896	6,000.00	
March 3, 1899	2,162.00	
June 13, 1902	20,000.00	
		$65,662.00
Received from sale of material		20.68
Total		189,114.50

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Hyannis Harbor, Massachusetts, during the calendar year ending December 31, 1901, is estimated as follows (based mainly upon reports received from Messrs. T. Crocker & Sons, Hyannis, Mass.):

Commerce arriving at and leaving Hyannis Harbor, calendar year 1901.

	Tons.
Cotton and products	22
Tobacco	25
Grains and forage	2,400
Vegetables and truck	125
Live stock and products	45
Fish, oysters, etc	325
Lumber and products	5,583
Coal, minerals, etc	19,000
Fertilizers	50
General merchandise	1,200
Sundries	225
Total	29,000

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	
Steam:			
Freight and passenger	65	10	300
Freight, mainly	20	12	450
Passenger, mainly	45	9	400
Fishing	25	6	70
Tugs	265	11	80
Pleasure boats	215	7	75
Sail:			
Freight	325	12	400
Fishing boats	350	3	6
Oyster boats	15	4	8
Pleasure boats, large	70	8	60
Pleasure boats, small	270	3	8
Barges	125	14	500

D 2.

HARBOR OF REFUGE AT NANTUCKET, MASSACHUSETTS.

Operations during the past fiscal year.—Nothing was expended during the past fiscal year and no work was done.

Operations contemplated for the fiscal year ending June 30, 1903.—The river and harbor act of June 13, 1902, provides for "Improving harbors at Hyannis and Nantucket, Massachusetts: Continuing improvement and for maintenance and repairs, thirty-five thousand dollars;" money procured from this appropriation will be expended in building up the breaches in the jetties as far as possible.

Money statement.

Amount appropriated by river and harbor act approved June 13, 1902	$15,000.00
July 1, 1902, balance unexpended	15,000.00
Amount (estimated) required for completion of existing project	100,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	100,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

AMOUNTS APPROPRIATED.

Previous projects.

May 23, 1825, survey	$300.00	
March 2, 1829	30,000.00	
March 2, 1831	8,265.00	
July 3, 1832	6,000.00	
June 14, 1844	1,169.75	
		$45,734.75

Existing project.

July 14, 1880	$50,000.00	
March 3, 1881	25,000.00	
August 3, 1882	25,000.00	
July 5, 1884	10,000.00	
August 5, 1886	15,000.00	
August 11, 1888	20,000.00	
September 19, 1890	25,000.00	
July 13, 1892	25,000.00	
August 18, 1894	25,000.00	
June 3, 1896	20,000.00	
March 3, 1899	20,000.00	
June 13, 1902	15,000.00	
		275,000.00
Total		320,734.75

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Nantucket Harbor, Massachusetts, during the calendar year ending December 31, 1901, is estimated as follows (based mainly upon reports received from various citizens of Nantucket):

Commerce arriving at and leaving Nantucket Harbor, calendar year 1901.

	Tons.
Tobacco	40
Rice	6
Grains and forage	1,560
Vegetables and truck	450
Live stock and products	30
Fish, oysters, etc	780
Naval stores	7
Lumber and products	3,000
Coal, minerals, etc	14,200
Fertilizers	90
Machinery	2,000
General merchandise	3,000
Sundries	650
Total	25,813

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	
Steam:			
Freight and passenger	500	8	500
Freight mainly	20	7	100
Passenger mainly	45	7	200
Fishing	5	5	6
Tugs	25	5	6
Pleasure boats	50	6	5
Sail:			
Freight	30	7	6
Fishing boats	65	4	5
Oyster boats	2	3	3
Pleasure boats, large	125	5	6
Pleasure boats, small	365	4	3

D 3.

IMPROVEMENT OF VINEYARD HAVEN HARBOR, MASSACHUSETTS.

A description of the work may be found in the Annual Reports of the Chief of Engineers for 1882, page 594; 1887, page 577, and for 1889, page 612, and a map of the same in the report for 1893, page 812.

For dimensions of walls and details of construction see Annual Report of the Chief of Engineers for 1896, Part I, page 632.

Operations during the past fiscal year.—No works of improvement were in progress during the past fiscal year.

Operations contemplated for the fiscal year ending June 30, 1903.—It is proposed to apply the balance of funds to repairing existing works.

Money statement.

July 1, 1901, balance unexpended	$5,032.65
June 30, 1902, amount expended during fiscal year	420.00
July 1, 1902, balance unexpended	4,612.65

AMOUNTS APPROPRIATED.

Existing project.

April 11, 1888	$25,000	June 3, 1896	$7,000
September 19, 1890	10,000	March 3, 1899	3,000
July 3, 1892	7,500		
August 18, 1894	7,500	Total	60,000

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Vineyard Haven Harbor, Massachusetts, during the calendar year ending December 31, 1901, is estimated as follows, based on the best information obtainable:

Commerce arriving at and leaving Vineyard Haven, calendar year 1901.

	Tons.
Cotton and products	50
Tobacco	25
Rice	45
Grain and forage	2,500
Vegetables and truck	65
Live stock and products	400
Fish, oysters, etc	2,700
Naval stores	15
Lumber and products	19,000
Coal, minerals, etc	90,000
Fertilizers	600
Machinery	85
General merchandise	9,000
Sundries	2,000
Total	126,000

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	
Steam:			
Freight and passenger	1,100	7	250
Freight, mainly	780	17	1,500
Passenger, mainly	60	7	250
Fishing	125	11	150
Tugs	800	14	200
Pleasure boats	600	8	50
Sail:			
Freight	2,200	19	1,400
Fishing boats	1,200	11	125
Oyster boats	10	12	25
Pleasure boats, large	500	13	100
Pleasure boats, small	1,600	5	50
Barges	2,200	20	1,500

D 4.

IMPROVEMENT OF WOODS HOLE CHANNEL, MASSACHUSETTS.

Operations during the past fiscal year.—Nothing was expended during the past fiscal year and no work of improvement was in progress.

Operations contemplated for the fiscal year ending June 30, 1903.—It is proposed to expend funds as made available in first completing the southern half of the channel and then widening the 13-foot depth to the northward until the full width is secured as appropriations are made by Congress.

Money statement.

Amount appropriated by river and harbor act approved June 13, 1902	$20,000.00
July 1, 1902, balance unexpended	20,000.00
Amount (estimated) required for completion of existing project	336,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	150,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

August 10, 1852	$25,000.00
March 3, 1879	15,000.00
August 2, 1882	52,000.00
July 5, 1884	25,000.00
August 5, 1886	14,500.00
March 2, 1895	5,000.00
June 3, 1896	20,000.00
March 3, 1899	20,000.00
June 13, 1902	20,000.00
Total	174,000.00
December 5, 1895, unexpended balance deposited to the credit of the Treasurer of the United States	400.08
Total	173,599.92

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Woods Hole, Mass., by water during the calendar year ending December 31, 1901, is estimated as follows (based mainly upon reports received from Mr. Walter O. Luscombe, of Woods Hole, Mass.):

Commerce arriving at and leaving Woods Hole, calendar year 1901.

	Tons.
Grains and forage	3,850
Vegetables and truck	27
Live stock and products	220
Fish, oysters, etc	330
Naval stores	44
Lumber and products	6,600
Coal, minerals, and products	6,600
Fertilizers	275
General merchandise	1,320
Total	19,266

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	
Steam:			
Freight and passenger	400	10	900
Freight mainly	100	7	25
Passenger mainly	200	11	50
Fishing	50	8	30
Tugs	40	10	100
Pleasure boats	100	10	100
Sail:			
Freight	100	8	150
Fishing boats	175	8	50
Pleasure boats, large	50	4	15
Pleasure boats, small	200	3	5

D 5

IMPROVEMENT OF NEW BEDFORD HARBOR, MASSACHUSETTS.

Operations during the past fiscal year.—No money was expended and no works of improvement were in progress during the fiscal year.

Operations contemplated for fiscal year ending June 30, 1903.—It is proposed to expend the available funds in completing the anchorage area.

Money statement.

Amount appropriated by river and harbor act approved June 13, 1902	$37,700.00
July 1, 1902, balance unexpended	37,700.00

AMOUNTS APPROPRIATED.

July 4, 1836	$10,000.00	March 3, 1899	$44,000.00
July 7, 1838	7,691.37	June 13, 1902	37,700.00
March 3, 1875	10,000.00		
August 14, 1876	10,000.00	Total	164,391.37
August 11, 1888	10,000.00	Received from sale of material	9.00
September 19, 1890	10,000.00		
July 13, 1892	7,500.00		
August 18, 1894	7,500.00	Total	164,400.37
June 3, 1896	10,000.00		

COMMERCIAL STATISTICS.

The commerce arriving at and leaving New Bedford, Mass., by water during the calendar year 1901 is estimated as follows (based mainly upon reports received from Mr. George F. Bartlett, collector of customs, New Bedford, Mass.):

Commerce arriving at and leaving New Bedford, calendar year 1901.

	Tons.
Cotton and products	16,800
Tobacco	500
Grain and forage	16,000
Vegetables and truck	7,000
Live stock and products	1,000
Fish, oysters, etc	6,500
Lumber and products	33,302
Coal, minerals, and products	465,000
Fertilizers	3,500
General merchandise	88,000
Sundries	15,000
Total	651,602

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	
Steam:			
Tugs	690	8	50
Freight and passenger	675	8	560
Freight mainly	425	15	1,000
Passenger mainly	500	8	60
Fishing	100	4	10
Pleasure boats	100	10	110
Sail:			
Freight	1,100	13	1,100
Fishing boats	600	5	10
Pleasure boats, large	310	11	150
Pleasure boats, small	950	5	15
Barges	456	12	900

D 6.

IMPROVEMENT OF TAUNTON RIVER, MASSACHUSETTS.

Operations during the past fiscal year.—No work of improvement was in progress during the past fiscal year.

Operations contemplated for the fiscal year ending June 30, 1903.—It is proposed to continue widening and deepening the channel below Berkley Bridge.

Money statement.

Amount appropriated by river and harbor act approved June 13, 1902	$5,000.00
July 1, 1902, balance unexpended	5,000.00

AMOUNTS APPROPRIATED.

Previous projects.

July 11, 1870	$10,000	
March 3, 1871	10,000	
June 10, 1872	10,000	
March 3, 1873	10,000	
June 23, 1874	10,000	
March 3, 1875	10,000	
June 18, 1878	2,000	
March 3, 1879	1,000	
		$63,000

Present project.

July 14, 1880	$17,500	
March 3, 1881	25,000	
August 2, 1882	25,000	
July 5, 1884	28,500	
September 19, 1890	7,000	
July 3, 1892	7,000	
August 18, 1894	5,000	
June 3, 1896	5,000	
March 3, 1899	7,000	
June 13, 1902	5,000	
		$130,000
Total		193,000

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Taunton River, Massachusetts, by water during the calendar year ending December 31, 1901, is estimated as follows (based mainly upon reports received from the Staples Coal Company, Taunton, Mass.):

Commerce arriving at and leaving Taunton River, calendar year 1901.

	Tons.
Cotton and products	5,000
Grains and forage	40,000
Lumber and products	25,000
Coal, minerals, and products	475,000
General merchandise	2,000
Sundries	11,000
Fish, oysters, etc	50
Total	553,050

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
Steam:		*Feet.*	
Tugs	525	7	50
Pleasure boats	100	4	12
Sail:			
Freight	680	9	200
Fishing boats	50	7	90
Pleasure boats, small	200	4	10
Barges	800	9	900

D 7.

IMPROVEMENT OF SAKONNET RIVER, RHODE ISLAND.

No work has been done and no funds expended during the past fiscal year.

Money statement.

July 1, 1901, balance unexpended	$40,000.00
July 1, 1902, balance unexpended	40,000.00

AMOUNTS APPROPRIATED.

June 3, 1896	$20,000
March 3, 1899	20,000
Total	40,000

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Sakonnet River, Rhode Island, during the calendar year ending December 31, 1901, is estimated as follows (based upon reports received from Mr. J. A. Pettey, general manager of the Sakonnet Steamboat Company):

Commerce arriving at and leaving Sakonnet River, calendar year 1901.

	Tons.
Tobacco	4
Rice	2
Grains and forage	5,480
Vegetables and truck	530
Live stock and products	140
Fish, oysters, etc	1,340
Lumber and products	975
Coal, minerals, etc	6,750
Fertilizers	230
Machinery	18
General merchandise	833
Sundries	28
Total	16,100

* * * * * * *

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
Steam:		*Feet.*	
Freight and passenger	2	8	150
Fishing	41	9	250
Pleasure boats	30	5	10
Sail:			
Fishing boats	40	5	12
Pleasure boats, large	21	8	80
Pleasure boats, small	200	3	2
Barges	11	18	600

D 8.

IMPROVEMENT OF PAWTUCKET (SEEKONK) RIVER, RHODE ISLAND.

Operations during the past fiscal year.—Nothing was expended during the past fiscal year, and no work of improvement was in progress.

Operations contemplated for the fiscal year ending June 30, 1903.—It is proposed to straighten and deepen the channel in its lower portions.

Money statement.

Amount appropriated by river and harbor act approved June 13, 1902	$28,500.00
July 1, 1902, balance unexpended	28,500.00

AMOUNTS APPROPRIATED.

March 2, 1867	$17,000.00	August 18, 1894	$25,000.00
July 11, 1870	8,000.00	June 3, 1896	20,500.00
March 3, 1871	7,000.00	March 3, 1899	30,000.00
June 10, 1872	10,000.00	June 13, 1902	28,500.00
March 3, 1873	10,000.00		
July 5, 1884	50,000.00	Total	336,000.00
August 5, 1886	30,000.00	Received from sale of material	19.59
August 11, 1888	35,000.00		
September 19, 1890	30,000.00		
July 13, 1892	35,000.00	Total	336,019.59

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Pawtucket River, Rhode Island, by water during the calendar year ending December 31, 1901, is estimated as follows (based mainly upon reports received from the Newell Coal and Lumber Company of Pawtucket, R. I.):

Commerce arriving at and leaving Pawtucket River, calendar year 1901.

	Tons.
Lumber and products	8,526
Coal, minerals, etc	192,801
Fertilizers	567
General merchandise	7,225
Sundries	7,204
Total	216,323

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	
Steam:			
Freight mainly	275	10	500
Passenger mainly	325	8	100
Tugs	600	7	80
Miscellaneous	150	5	50
Sail:			
Freight	200	10	300
Pleasure boats, large	25	7	100
Pleasure boats, small	350	3	4
Barges	140	10	500

D 9.

IMPROVEMENT OF PROVIDENCE RIVER AND NARRAGANSETT BAY, RHODE ISLAND.

Operations during the past fiscal year.—The amount expended during the past fiscal year was $156,920.59.

At the beginning of the fiscal year work was in progress on the new channel through the "Western Passage" of Narragansett Bay

and was continued through the year. The reach below Warwick Point was completed. Two dredges were employed during the entire year, 1 dredge during four months and 2 dredges during three months each. Nine hundred and twelve thousand seven hundred and eighty-six cubic yards of sand and mud were removed from the channel during the fiscal year, making a total under the present contract of 1,066,972 cubic yards out of a total estimated amount of 1,510,000.

A survey of the reach below Warwick Point was made upon the completion of the dredging, and the shoal portions of the channel were redredged, leaving it of the required dimensions.

Operations contemplated during the fiscal year ending June 30, 1903.—It is proposed to continue the work of dredging in the new ship channel through the "Western Passage," and commence the work of enlarging the anchorage area in Providence Harbor

Money statement.

July 1, 1901, balance unexpended	$179,986.12
Amount appropriated by river and harbor act approved June 13, 1902	100,000.00
Amount appropriated by sundry civil act approved June 28, 1902	84,560.00
	364,546.12
June 30, 1902, amount expended during fiscal year	156,920.59
July 1, 1902, balance unexpended	207,625.53
July 1, 1902, outstanding liabilities	29,772.53
July 1, 1902, balance available	177,853.00
July 1, 1902, amount covered by uncompleted contracts	72,656.60
Amount (estimated) required for completion of existing project	507,777.50
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	200.000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

August 30, 1852	$5,000.00	July 13, 1892	50,000.00
August 30, 1852, survey	1,500.00	August 18, 1894	17,500.00
May 2, 1867	25,000.00	June 3, 1896	25,000.00
May 11, 1870	5,000.00	June 4, 1897	125,000.00
July 15, 1870	2,500.00	July 1, 1898	125,000.00
June 10, 1872	10,000.00	March 3, 1899	10,000.00
March 3, 1873	10,000.00	June 6, 1900	54,489.00
March 18, 1878	5,000.00	March 3, 1901	59,000.00
June 18, 1878	50,000.00	June 13, 1902	100,000.00
March 3, 1879	60,000.00	June 28, 1902	84,560.00
July 14, 1880	60,000.00		
March 3, 1881	60,000.00	Total	1,274,549.00
August 2, 1882	125,000.00	Received from sale of material	143.39
July 5, 1884	85,000.00		
August 5, 1886	30,000.00	Total	1,274,692.39
August 11, 1888	40,000.00		
September 19, 1890	50,000.00		

CONTRACT IN FORCE.

Contractor: International Contracting Company.
Date of approval: March 27, 1901.
To commence: April 1, 1901.
To complete: October 1, 1903.

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Providence River, Rhode Island, by water during the calendar year ending December 31, 1901, is estimated as follows (based mainly upon reports received from Mr. J. T. F. Bucklin, harbor master, and other citizens of Providence, R. I.):

Commerce arriving at and leaving Providence River, calendar year 1901.

	Tons.
Lumber and products	42,817
Coal, minerals, etc	2,000,662
Oil, naphtha, etc	14,426
General merchandise	15,555
Sundries	788,361
Bricks	4,198
Total	2,866,019

During the year, a line of fruit steamers was established for commerce with the South.

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	
Steam:			
Freight and passenger	710	12	600
Freight, mainly	305	18	1,450
Passenger, mainly	3,550	7	519
Fishing	1,400	3	30
Tugs	1,500	13	100
Pleasure boats	1,500	5	30
Sail:			
Freight	850	18	1,500
Pleasure boats, large	400	7	40
Pleasure boats, small	1,500	3	7
Barges	1,700	16	1,200

D 10.

IMPROVING GREEN JACKET SHOAL, PROVIDENCE RIVER, RHODE ISLAND.

Operations during the past fiscal year.—No operations were in progress during the fiscal year; the expenditures were for contingencies, amounting to $100.

Operations contemplated for the fiscal year ending June 30, 1903.—The remaining portions of the shoal will be removed under the new project referred to above.

Money statement.

July 1, 1901, balance unexpended	$214.42
July 30, 1902, amount expended during fiscal year	100.00
July 1, 1902, balance unexpended	114.42

AMOUNTS APPROPRIATED.

Present project.

August 5, 1886	$26,250	August 18, 1894	$7,500
August 11, 1888	28,000	June 3, 1896	7,500
September 19, 1890	25,000		
July 13, 1892	10,000	Total	104,250

COMMERCIAL STATISTICS.

For the commercial statistics see report of improvement of Providence River and Narragansett Bay, Rhode Island.

D 11.

IMPROVEMENT OF FALL RIVER HARBOR, MASSACHUSETTS.

Operations during the past fiscal year.—No work was in progress during the fiscal year.

Operations contemplated for the fiscal year ending June 30, 1903.—It is proposed to continue the dredging of the proposed new channel, first completing that portion along the city front and then dredging across the flats.

Money statement.

Amount appropriated by river and harbor act approved June 13, 1902	$38,000.00
July 1, 1902, balance unexpended	38,000.00
Amount (estimated) required for completion of existing project	117,412.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	117,412.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

MOUNTS APPROPRIATED.

Previous projects.

June 23, 1874	$10,000	
March 3, 1875	10,000	
August 14, 1876	10,000	
		$30,000

Existing project.

March 3, 1899	20,000	
June 13, 1902	38,000	
		58,000
Total		88,000

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Fall River Harbor, Massachusetts, by water during the calendar year ending December 31, 1901, is estimated as follows (based upon reports received from Mr. James Brady, collector of customs, and other citizens of Fall River, Mass.):

Commerce arriving at and leaving Fall River Harbor, calendar year 1901.

	Tons.
Cotton and products	185,000
Lumber and products	110,000
Coal, minerals, etc	740,000
General merchandise	2,400,000
Total	3,435,000

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
Steam:		*Feet.*	
Freight and passenger	755	12	2,800
Freight mainly	500	10	1,500
Passenger mainly	800	8	500
Tugs	430	7	85
Pleasure boats	375	7	100
Sail:			
Freight	425	10	175
Pleasure boats, large	320	6	11
Pleasure boats, small	1,800	3	3
Barges	735	12	500

D 12.

IMPROVEMENT OF NEWPORT HARBOR, RHODE ISLAND.

Operations during the past fiscal year.—During the year a shoaling had occurred off the end of the wharf used by the Fall River Line steamers, reducing the available depth to 13 feet at mean low water, with an area of about 300 square yards. The shoals caused the steamboats to ground, necessitating removal. An allotment of $750 from the appropriation for "Emergencies in River and Harbor Works" was made by the Secretary of War under date of June 2, 1902. A dredging plant was hired and the shoal removed by taking out 600 cubic yards of gravel and silt.

Under date of August 28, 1901, the Secretary of War approved the harbor line as recommended by the Board of Engineers constituted by Special Orders, No. 44, Headquarters Corps of Engineers, December 1, 1897, with one slight modification. The sum of $50 was allotted from the appropriation for "Examinations, Surveys, and Contingencies of Rivers and Harbors" for placing stone bounds for marking this harbor line, of which $37.87 was expended during the fiscal year for that purpose. A separate report with description of the line is submitted on this subject.

Operations contemplated for the fiscal year ending June 30, 1903.—It is proposed to remove the shoal places remaining in the harbor.

Money statement.

August 29, 1901, amount allotted from appropriation for "Examining Surveys and Contingencies of Rivers and Harbors"	$50.00
Amount appropriated by river and harbor act approved June 13, 1902	39,000.00
Amount allotted from emergency act June 6, 1900	750.00
	39,800.00
June 30, 1902, amount expended during fiscal year	[a] 50.00
July 1, 1902, balance unexpended	39,750.00
July 1, 1902, outstanding liabilities	340.00
July 1, 1902, balance available	39,410.00

AMOUNTS APPROPRIATED.

March 3, 1873	$8,500.00	March 3, 1899	$15,000.00
June 23, 1874	10,000.00	August 29, 1901	50.00
March 3, 1875	10,000.00	June 2, 1902	750.00
March 3, 1881	25,000.00	June 13, 1902	39,000.00
August 2, 1882	20,000.00	Received from sale of material	8.52
July 5, 1884	20,000.00		
August 5, 1886	15,000.00		
August 11, 1888	12,000.00	Total	235,308.52
September 19, 1890	12,500.00	Amount returned to Treasury of the United States	12.13
July 13, 1892	25,000.00		
August 18, 1894	7,500.00		
June 3, 1896	15,000.00	Total	235,296.39

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Newport Harbor, Rhode Island, during the calendar year ending December 31, 1901, is estimated as follows (based mainly upon reports received from Mr. Clarence A. Hammett, collector of customs, and other citizens of Newport, R. I.):

Commerce arriving at and leaving Newport Harbor, calendar year 1901.

	Tons.
Cotton and products	140
Tobacco	50
Grains and forage	2,200
Vegetables and truck	1,000
Fish, oysters, etc	140,000
Naval stores	1,000
Lumber and products	37,000
Coal, minerals, etc	85,000
Fertilizers	1,200
Machinery	500
General merchandise	75,000
Sundries	20,000
Total	363,090

New transportation companies established during the year—steamer *New Shoreham*, owned by town of New Shoreham, to Block Island.

[a] $12.13 returned to Treasury of the United States.

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	
Steam:			
Freight and passenger	1,450	12	2,050
Freight, mainly	420	10	1,200
Passenger, mainly	4,000	9	600
Fishing	650	9	200
Tugs	825	9	97
Pleasure boats	1,400	7	125
Sail:			
Freight	900	10	160
Fishing boats	900	6	30
Pleasure boats, large	1,825	6	15
Pleasure boats, small	3,000	3	4
Barges	350	12	650

D 13.

HARBOR OF REFUGE AT POINT JUDITH, RHODE ISLAND.

Operations during the past fiscal year.—The amount expended during the past fiscal year was for contingencies and amounted to $1,667.31.

Three small lights were maintained on the breakwater during the year. During eleven months of the year 30 steamers, 270 schooners, 66 sloops, and 10 barges took refuge behind the breakwater.

Work required to complete the existing project.—The work required to complete the existing project is the raising of the crest of the eastern arm of the breakwater to 9 feet above high water, the present height being 6 feet, the extension of the western arm 1,980 feet, and the construction of the easterly detached arm and continuing it to the shore.

Operations contemplated for the fiscal year ending June 30, 1903.—Building part of the easterly detached arm and continuing it to the shore as well as strengthening the main work.

Money statement.

July 1, 1901, balance unexpended	$4,887.93
Amount appropriated by river and harbor act approved June 13, 1902	100,000.00
	104,887.93
June 30, 1902, amount expended during fiscal year	1,667.31
July 1, 1902, balance unexpended	103,220.62
July 1, 1902, outstanding liabilities	125.00
July 1, 1902, balance available	103,095.62
Amount (estimated) required for completion of existing project	344,310.98
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	344,310.98

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

AMOUNTS APPROPRIATED.

September 19, 1890	$75,000.00	June 13, 1902	$100,000.00
July 13, 1892	75,000.00		
March 3, 1893	100,000.00	Total	1,350,000.00
August 18, 1894	100,000.00	Received from sale of material	38.61
March 2, 1895	300,000.00		
June 11, 1896	300,000.00		
June 4, 1897	300,000.00	Total	1,350,038.61

COMMERCIAL STATISTICS.

The tonnage of vessels passing Point Judith, R. I., during the calendar year ending December 31, 1901, is estimated as follows (based mainly upon reports received from Mr. Asa Church, keeper Point Judith life-saving station, Rhode Island, in gross tons):

Tonnage of vessels passing Point Judith, calendar year 1901.

	Gross tons.
Steamers (freight, fish, and passenger)	9,000,000
Yachts (steam and sail)	1,200,000
Schooners (2 to 6 masts)	32,000,000
Ships, barks, and brigs, barkentines, etc	240,000
Sloops	50,000
Barges	7,750,000
Total	50,240,000

D 14.

IMPROVEMENT OF ENTRANCE TO POINT JUDITH POND, RHODE ISLAND.

The river and harbor act of June 13, 1902, provides as follows:

A Board of Engineers shall be appointed by the Secretary of War, who shall make * * * an examination of Point Judith Pond with a view to determining whether it is advisable to enlarge the entrance to said pond from the ocean, and if said enlargement is, upon examination, found to be desirable, an estimate of the cost thereof shall be made. The expense of said Board shall be paid from the unexpended balance remaining to the credit of the entrance to Point Judith Pond.

Operations during the past fiscal year.—No work done and no funds expended during the past fiscal year.

Operations contemplated for the fiscal year ending June 30, 1903.—The expenses of the Board of Engineers will be paid from the balance remaining to the credit of the appropriation for this work.

Money statement.

July 1, 1901, balance unexpended	$9,481.62
July 1, 1902, balance unexpended	9,481.62

AMOUNTS APPROPRIATED.

July 13, 1892	$7,500
August 18, 1894	2,500
Total	10,000

COMMERCIAL STATISTICS.

For the commercial statistics, see report for harbor of refuge at Point Judith, R. I.

D 15.

HARBOR OF REFUGE AT BLOCK ISLAND, RHODE ISLAND.

Operations during the past fiscal year.—The amount expended during the past fiscal year was $559.01. On April 15, 1902, an allotment of $4,500 was made from the appropriation for "Emergencies in River and Harbor Works" for the removal of the shoal which had again formed at the entrance to the inner harbor. Proposals were invited for dredging the shoal to a depth of 10 feet at mean low water, and a contract for the work entered into with Charles M. Cole, of Fall River, Mass., under date of May 8, 1902, at the rate of 24 cents per cubic yard. The work of dredging was commenced June 2 and completed on June 20. The amount of sand removed and dumped in the deep water was 9,068 cubic yards, leaving a clear entrance channel of 10 feet depth at mean low water.

Lights were maintained at the entrance to the harbor during the year.

Work required to complete the existing project.—The work required to complete the existing project is to repair the main breakwater and stop sand leaks through certain portions of it, to repair and strengthen the west breakwater of the enlarged inner harbor, to dredge the enlarged harbor to a depth of 10 feet at mean low water, and to remove the crib work of the small inner harbor, originally built to protect Government plant.

Operations contemplated for the fiscal year ending June 30, 1903.—It is proposed to repair a portion of the main breakwater and make it sand tight.

Money statement.

July 1, 1901, balance unexpended	$1,268.92
Amount allotted from emergency act June 6, 1900	4,500.00
Amount appropriated by river and harbor act approved June 13, 1902	30,000.00
	35,768.92
June 30, 1902, amount expended during fiscal year	559.01
July 1, 1902, balance unexpended	35,209.91
July 1, 1902, outstanding liabilities	2,393.38
July 1, 1902, balance available	32,816.53
Amount (estimated) required for completion of existing project	48,985.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	48,985.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

AMOUNTS APPROPRIATED.

July 11, 1870	$30,000	August 11, 1888	15,000
March 3, 1871	75,000	September 19, 1890	15,000
June 10, 1872	50,000	July 13, 1892	24,000
March 3, 1873	50,000	August 18, 1894	2,500
June 23, 1874	20,000	June 3, 1896	5,000
March 8, 1875	20,000	March 3, 1899	10,000
August 14, 1876	40,000	April 15, 1902	4,500
July 14, 1880	6,000	June 13, 1902	30,000
August 2, 1882	19,000		
July 4, 1884	15,000	Total	451,000
August 5, 1886	20,000		

CONTRACT IN FORCE.

Contractor: Charles M. Cole.
Date of contract: May 8, 1902.
To commence: In ten days after signature.
To complete: In seventy-five days after commencement.
Rate: Twenty-four cents cubic yard.

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Block Island by water during the calendar year ending December 31, 1901, is estimated as follows (based mainly upon reports received from local parties):

Commerce arriving at and leaving Block Island, calendar year 1901.

	Tons.
Cotton and products	20
Tobacco	37
Rice	14
Grains and forage	4,000
Vegetables and truck	1,000
Live stock and products	4,100
Fish, oysters, etc	19,500
Naval stores	20
Lumber and products	8,500
Coal, minerals, etc	16,500
Fertilizers	1,000
Machinery	275
General merchandise	7,900
Sundries	10,500
Total	73,366

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
Steam:		*Feet.*	
Freight and passenger	925	7½	500
Freight, mainly	90	8	275
Passenger, mainly	200	7½	350
Fishing	1,000	9	175
Tugs	450	8	175
Pleasure boats	2,000	8½	150
Sail:			
Freight	700	9	150
Fishing boats	9,500	8	75
Oyster boats	200	7	30
Pleasure boats, large	2,500	8½	25
Pleasure boats, small	8,200	6½	10
Barges	50	10	350

D 16.

IMPROVEMENT OF GREAT SALT POND, BLOCK ISLAND, RHODE ISLAND.

Block Island is about 12 miles south of Point Judith, and 15 miles northeast of Montauk Point; it is about 5 miles long, with an average width of 2 miles; has a population of 1,300, and the valuation of ratable property, as returned by the board of assessors for 1901, was as follows: Real estate, $714,600; personal estate, $166,200; total, $880,800. About midway of the island, north and south, is a salt-water

pond, known as the Great Salt Pond. Its water surface covers 700 acres, about 150 acres of which has a depth of 15 feet and over.

Operations during the past fiscal year.—The amount expended during the past fiscal year was $5,253.24. Under date of July 26, 1901, a contract was entered into with Eugene S. Belden, of Hartford, Conn., for furnishing and placing stone for repairing the outer end of the south jetty. Work under this contract was commenced August 1, and completed August 27. Three thousand nine hundred and fifty-eight tons of stone, at a cost of $1.23 per ton, were placed in the jetty.

Operations contemplated for the fiscal year ending June 30, 1903.—It is proposed to apply the available funds to extending the south jetty, and in dredging, as provided in the act of June 13, 1902.

Money statement.

July 1, 1901, balance unexpended	$5,253.24
Amount appropriated by river and harbor act approved June 13, 1902	50,000.00
	55,253.24
June 30, 1902, amount expended during fiscal year	5,253.24
July 1, 1902, balance unexpended	50,000.00
Amount (estimated) required for completion of existing project	165,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	100,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

AMOUNTS APPROPRIATED.

June 3, 1896	$40,000
March 3, 1899	50,000
June 13, 1902	50,000
Total	140,000

CONTRACT IN FORCE.

Contractor: Eugene S. Belden.
Date of approval: July 26, 1901.[a]
To commence: Ten days after signature.
To complete: Two months after commencement.
Rate per ton of 2,000 pounds in place: $1.23.

COMMERCIAL STATISTICS.

The commerce arriving at and leaving the Great Salt Pond, Block Island, Rhode Island, by water during the calendar year ending December 31, 1901, is estimated as follows (based upon the most reliable information obtainable):

[a] Emergency contract. No approval. This is the date of contract.

Commerce arriving at and leaving the Great Salt Pond, calendar year 1901.

	Tons.
Grain and forage	3,000
Fish, oysters, etc	3,000
Lumber and products	2,000
Coal, minerals, etc	3,000
General merchandise	8,000
Vegetables and truck	4,000
Fertilizers	300
Machinery	1,000
Sundries	1,000
Live stock and products	300
Total	25,600

New transportation company established during the year: Steamer *New Shoreham*, owned and operated by the town of New Shoreham, runs the year round from this harbor to Newport, R. I., carrying United States mail.

Vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	
Steam:			
Freight and passenger	1,200	10	600
Fishing	2,000	12	300
Tugs	600	8	75
Pleasure boats	6,000	3	6
Sail:			
Freight	500	10	100
Fishing boats	8,000	10	300
Pleasure boats, large	4,000	6	10
Pleasure boats, small	8,000	3	5
Barges	600	10	700

D 17.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Wreck of schooner Electa Bailey.—This vessel was stranded on Hardings Beach, Chatham, Mass., at the entrance to the channel leading into Stage Harbor, and was reported as an obstruction to navigation on May 9. By Department indorsement of May 13, 1901, authority was received and an allotment made for the removal of the wreck.

The work of removing the wreck was commenced in August, 1901, with hired labor and the use of a hired schooner, and completed during the same month. About 800 pounds of dynamite were used. The total cost of the work was $544.25.

Water-logged dump scow in Newport Harbor, Rhode Island.—This wreck was reported October 2, 1901, as lying outside the harbor line in Newport Harbor, menacing vessels using the harbor. Her removal was authorized, and an allotment therefor made October 7, 1901, and October 15, 1901, the scow was taken outside the harbor and completely destroyed, at a cost of $100.

Wreck of schooner John Cullana.—This wreck was reported October 19, 1901, as lying in about 11 feet of water about SSW. from Monomoy light-house, Massachusetts, and about N. by W. ½ W. from SW. buoy on Common flat, constituting a dangerous obstruction to navigation. Her removal was authorized, and an allotment made therefor October 23, 1901. The work of removal was commenced in November

by hired labor and the use of a hired schooner, and completed in December. About 800 pounds of dynamite were used, and the wreck completely destroyed, at a total cost of $497.15.

Wreck of schooner Alfred W. Fiske.—This wreck was reported October 29, 1901, as having gone ashore and sunk on Stone Horse shoal, Monomoy light bearing N. by W. ½ W., distant 2½ miles; she was loaded with paving stones, and lay in the track of vessels going over the Stone Horse rips, and constituted a dangerous obstruction to navigation. Her removal was authorized November 4, 1901. The work of removal was commenced in December by hired labor and the use of a hired schooner, and was completed during the same month. About 700 pounds of dynamite were used breaking up the woodwork and scattering the stone, all at a total cost of $1,322.70.

Wreck of schooner Douglas Haynes.—This wreck was reported December 9, 1901, as lying sunk in 4½ fathoms of water between Shovelful and Pollock Rip shoals, Massachusetts, constituting a dangerous obstruction to navigation. Her removal was authorized December 18, 1901. A search made for her location by the wrecking party, covering a radius of 3 miles around her position when she constituted an obstruction to navigation, failed to find her. The cost of this work was $553.

Wreck of schooner J. G. Fell.—This wreck was reported January 20, 1902, as having sunk November 28, 1901, inside of Point Judith Harbor, near the western entrance to the harbor, constituting a dangerous obstruction to navigation. Her removal was authorized January 29, 1902. The work of removal was commenced February 21, 1902, by hired labor and the use of a hired schooner and was completed by February 26, 1902. About 700 pounds of dynamite were used in breaking up the vessel, at a cost of $990.

Wreck of steamer Williamsport.—This wreck was reported May 12, 1902, as lying sunk 2 miles northeast of Pollock Rip light-ship, loaded with coal, having a gross tonnage of 1,283, constituting a dangerous obstruction to navigation. Her removal was authorized and allotment made May 20, 1902. The work of removal will be commenced as soon as arrangements can be made to get the wrecking party in the field.

D 18.

ESTABLISHMENT OF HARBOR LINES IN NEWPORT HARBOR, RHODE ISLAND.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, December 6, 1897.

SIR: In the matter of establishment of harbor lines at Newport Harbor, R. I., the local engineer, Maj. D. W. Lockwood, Corps of Engineers, in a report dated September 11, on public hearing held August 16, 1897, withdrew his previous recommendations in the premises and recommended instead that a resurvey of the water front be made and that the fixing of harbor lines be then referred to a Board of Engineers.

Further action was suspended pending the results of the resurvey,

which was authorized and which is now reported by Major Lockwood to have been completed and platted.

A Board of Engineers, consisting of Majors A. M. Miller, D. W. Lockwood, and S. S. Leach, Corps of Engineers, was constituted by Special Orders, No. 44, Headquarters Corps of Engineers, December 1, 1897, to consider the subject of harbor lines for Norwalk Harbor, Conn., and I have the honor to recommend that, in view of the interests involved, the question of establishment of harbor lines at Newport Harbor be also referred to this Board, and that a public hearing be held at which all parties interested will be given an opportunity to be heard.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. R. A. ALGER,
Secretary of War.

[First indorsement.]

WAR DEPARTMENT, *December 9, 1897.*

Approved as within recommended.

By order of the Secretary of War:

A. N. THOMPSON,
Acting Chief Clerk.

REPORT OF MAJ. GEO. W. GOETHALS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., July 24, 1901.

GENERAL: In compliance with instructions contained in Department letter of May 24, 1901, relative to harbor lines at Newport Harbor, R. I., I have the honor to state that I have consulted Senator Wetmore and Representative Bull in connection with the objections that they may have in regard to the proposed harbor lines, and forward herewith a letter from each to the effect that whatever objections may previously have existed do not obtain now, and that they have no objections to the proposed line. Under date of January 19, 1901, a portion of the line, 594 feet in length, along the south side of Long wharf, was changed by moving it 15.4 feet at the east end and 13.3 feet at the west end from its position indicated on the map, and with this modification it is respectfully recommended that the harbor line be approved as indicated. The modification is shown on the accompanying tracing[a] by a lead-pencil mark.

Very respectfully, your obedient servant,

GEO. W. GOETHALS,
Major, Corps of Engineers, U. S. Army.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. Army.

[a] Not printed.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
July 29, 1901.

Respectfully returned to Major Goethals, with request that bearings and distances of the harbor lines recommended by the Board in its report of January 27, 1898, and shown upon the tracing herewith, be indicated on the map, and that the lines be fully described by him in a separate paper.

It is desired in this connection that additional lines be drawn upon the tracing along the south side of Long Wharf, so as to show plainly the modification recommended by Major Goethals, on account of the permission granted by the Secretary of War on January 19, 1901, to the Long Wharf Commission, of Newport, and that said modified line be submitted in the full descriptive paper for the one recommended by the Board.

To be returned.

A. MACKENZIE,
Acting Chief of Engineers.

[Second indorsement.]

UNITED STATES ENGINEER OFFICE,
Newport, R. I., August 22, 1901.

Respectfully returned to the Chief of Engineers, United States Army, with a description of the harbor lines in a separate paper, and with bearings and distances indicated on the map. The line on the south side of Long Wharf has been modified to agree with the permission granted by the Secretary of War on January 19, 1901.

GEO. W. GOETHALS,
Major, Corps of Engineers.

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
August 27, 1901.

Respectfully submitted to the Secretary of War.

The final consideration of the establishment of harbor lines at Newport, R. I., has, by instructions of the Secretary of War, been held in abeyance since April 5, 1898, to await the expressed wish of Senator Wetmore and Representative Bull, of Rhode Island, that the matter be taken up and disposed of. From papers herewith it appears that the lines selected meet with the approval of these gentlemen, and that no further objection to said lines is made by them.

This matter received consideration at the hands of a Board of Engineers in 1898, and the lines now presented are practically identical with those adopted by the Board, whose report is herewith. Approval by the Secretary of War is recommended.

The lines selected are described in a separate paper, and delineated upon the accompanying tracing, both of which have been prepared for the Secretary's signature.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

REPORT OF BOARD OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., January 27, 1898.

GENERAL: The Board of Engineer Officers, constituted by Special Orders, No. 44, Headquarters Corps of Engineers, United States Army, December 1, 1897, having been directed by Special Orders, No. 1, Headquarters Corps of Engineers, United States Army, January 6, 1898, to reassemble at Newport, R. I., upon the call of the senior member "to consider and report upon the subject of harbor lines in Newport Harbor, Rhode Island," has the honor to submit the following report: The Board consisted of Maj. Alexander M. Miller, Maj. Daniel W. Lockwood, and Maj. Smith S. Leach, Corps of Engineers, United States Army, and upon the call of the senior member held a public hearing on January 11, 1898, in the United States Engineer Office at Newport, R. I., all the members being present. A notice of the hearing had been published in two New York papers and in one local paper, and in addition to this a circular notice was sent to each riparian owner whose address was known, inviting him or her to be present and present his or her views on the subject. The meeting was called to order at 10 a. m., January 11, 1898, by the senior member, who stated the object of the hearing and also stated that it would be convenient if arguments were presented in writing as well as orally. The report[a] of a public hearing, held with reference to this same matter, by Maj. Daniel W. Lockwood, Corps of Engineers, United States Army, on August 18, 1897, and other papers[a] in connection with the subject, which had been forwarded by the Chief of Engineers, United States Army, to the senior member, were laid before the Board.

Many wharf owners and others whose interests might be affected by the establishment of a harbor line by the General Government were present, and all such as desired to do so were given an opportunity to express their views on the subject.

The public statutes of Rhode Island provide for a board of harbor commissioners consisting of three members, which is authorized to mark out harbor lines suitable to be established in the public waters of the State, subject to the approval of the governor and the senate, but specially exempt the waters immediately bordering on the towns in the counties of Newport and Washington extending to ship channel and the harbors in said counties from the provisions of the act, so that jurisdiction relating to harbor lines in Newport Harbor under the State law is vested in the legislature and not in the board of harbor commissioners.

[a] Not printed.

In March, 1873, the legislature passed an act defining and establishing a harbor line for a portion of the harbor of Newport, which has been amended at various times so as to change the original line in certain particulars.

The opposition developed at the hearing was with reference to the establishment of any harbor line in the harbor of Newport by the General Government, the ground taken being that as the State had already acted in the matter any action by the General Government was unnecessary, the intimation being that such action would practically be an interference with the rights of the State with regard to the public waters within its boundaries.

It was stated that as matters now stood, it was possible to effect by legislative action any change in the location of the line that might be found necessary in the interests of the community.

The president of the Old Colony Steamboat Company, the representative of the Providence and Newport Steamboat Company, and others owning wharves expressed themselves in favor of the establishment of a definite harbor line by the General Government, in order that their rights and privileges to and in the waters of the harbor might be clearly defined and fixed.

The Board does not deem it a part of its duty to comment on the general objections to the establishment of any harbor line in this harbor by the United States, as these are matters involving constitutional and legal questions which the Board does not consider itself required to pass on or discuss, but would respectfully invite attention to the remarks of Col. S. R. Honey which are recorded in the minutes[a] of the previous hearing of August 18, 1897, as showing the advanced position held by some in reference to this matter, and also the paper[a] submitted by the Hon. W. P. Sheffield. Colonel Honey referred to his statements made on the former occasion as expressing his views.

The Board made a careful examination of the water front of the harbor, and no one appearing in the afternoon, the hearing was adjourned at 4 p. m. without date.

It would appear that the primary object in defining a harbor line under the State law on the subject is the benefiting of the riparian owner by enabling him to acquire additional land or additional wharf facilities. This being the case, it would seem that the general interests of navigation might become of secondary consideration under such a state of affairs.

The Board having duly considered the various features of the subject, respectfully submits a map[a] of Newport Harbor, upon which is marked a line in red, which it recommends for adoption as the harbor line in Newport Harbor from near Coasters Harbor to the east point of Brentons Cove. In determining the line the Board has been guided by the following considerations:

1. To protect the interests of navigation by reserving for the general purposes of a harbor for general commerce such an area as the present and prospective needs of commerce, in its judgment, appear to require, with due regard to the physical features of the situation.

2. To disturb as little as possible present vested interests where the same do not seriously conflict with the first consideration.

[a] Not printed.

3. To select such a line as will conform to the foregoing and which can be definitely located, defined, and marked for ready reference.

It is respectfully recommended that, in case the line on the map is approved by the honorable Secretary of War, the map be returned to Maj. D. W. Lockwood, Corps of Engineers, in order that the line may be marked by proper reference points, and a full description of it and the reference points be prepared by him to be filed with the map.

Respectfully submitted.

A. M. MILLER,
Major, Corps of Engineers.
D. W. LOCKWOOD,
Major of Engineers.
SMITH S. LEACH,
Major of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. Army.

DESCRIPTION OF HARBOR LINE AT NEWPORT, R. I.

Commencing in the southwest portion of Brentons Cove in Newport Harbor, in about 14 feet of water at mean low tide, opposite a prominent point of rocks upon which is built the residence of E. D. Morgan; thence on an azimuth of 234° 31′ (N. 54° 31′ E., true) 3,400 feet, more or less, to the head of the city pier at the Harbor Park (so called) and to the intersection with a line passing through the center of the shot tower in Newport and tangent to the said City Pier; thence along this last-described line on an azimuth of 243° 55′ (N. 63° 55′ E., true) 1,960 feet, more or less, to its intersection with a line extending from a point in Wellington avenue, designated as Point No. 2, and more fully described below, to the southwest corner of Commercial wharf; thence along this line on an azimuth of 176° 09′ (N. 3° 51′ W., true) 1,890 feet, more or less, to the southwest corner of Commercial wharf; thence along the head of said Commercial wharf on an azimuth of 177° 30′ (N. 2° 30′ W., true) 108 feet, more or less, to the northwest corner of said wharf; thence along a line extending from the northwest corner of Commercial wharf to a point on Long wharf, designated as Point No. 3, and more fully described below, on an azimuth of 184° 19′ (N. 4° 19′ E., true) 1,543 feet, more or less, to its intersection with the southern side of A. A. Barker's pile wharf; thence westerly along the southern side of said pile wharf 53.5 feet to the southwest corner of the wharf; thence northerly along the west face of said pile wharf 7.5 feet to the intersection with a line extending westerly, the direction of which is marked by two points on the City wharf designated as Points Nos. 4 and 5, and which are more fully described below; thence along the last-described line on an azimuth of 78° 12′ (S. 78° 12′ W., true) 353 feet, more or less, to the intersection with the eastern side of the City wharf; thence southerly along the eastern side of the said City wharf 318 feet, more or less, to the southeast corner of the City wharf; thence along the south side of said wharf and in its prolongation 450 feet, more or less, to its intersection with the west side of Washington street prolonged; thence northerly along the west side of Washington street prolonged 272 feet, more or less, to its intersection with a line running parallel to the southerly side of Old Colony Steamboat Company's wharf and 15 feet to the southward of it; thence westerly along the last-described line 610 feet, more or less, to its intersection with a line running parallel to the heads of the wharves of the Old Colony Steamboat Company and 15 feet to the westward of them; thence along the last-described line 945 feet, more or less, to its intersection with the north side of Briggs's wharf prolonged; thence on an azimuth of 177° (N. 3° W., true) 5,470 feet, more or less, to a point on the southerly side of the causeway leading to the United States naval training station on Coasters Harbor Island, this last line being located by a point in the Harbor Park at the southerly end of the harbor designated as Point No. 6 and on the said causeway designated as Point No. 7, both of which points are more fully described below.

DESCRIPTIONS OF POINTS MARKING UNITED STATES HARBOR LINE IN NEWPORT HARBOR, RHODE ISLAND.

Point No. 1, forming one point marking the most southerly line of the harbor line, is on the Fort Adams Reservation near the shore line south of the artillery stables. From it the following angular readings are taken:

	°	′
Tangent to the head of the city pier and to the southeast corner of old stone wharf near artillery stables at Fort Adams, being the direction of the said portion of the harbor line	234	31
Shot tower in Newport	238	5
Northwest corner of E. D. Morgan's stone residence	243	59
Fort Adams flagstaff	172	51
Southeast corner of artillery stable	195	54
Zabriskie Memorial Church, Newport, R. I	207	35
City Hall dome	222	10
Trinity Church spire, Newport, R. I	226	31
Lime Rock light-house chimney and spire of First Congregational Church in Newport, R. I	229	44

Point No. 2, forming one point marking the line extending southerly from Commercial wharf, is in Wellington avenue on a prolongation of the base line of the survey of Newport Harbor of October, 1897, and is 105 feet to the eastward of the station at east end of base line and opposite a street between Houston street and Marchant street. From it the following angular readings are taken:

	°	′
Southwest corner of Commercial wharf, being the direction of this portion of the harbor line	176	9
Zabriskie Memorial Church	171	4
Breakwater light-house	155	48
Flag pole, Fort Adams	99	25
Base line of survey △ 3– △ 4	79	12
Shot tower	202	37
Lamp-post south side Wellington avenue, distant 37.4 feet	333	48
Northeast corner of house on Wellington avenue, the first story of which is of brick, distant 58 feet	23	48

(The two last objects are at the east and west corners of a street without name, between Houston street and Marchant street.)

Point No. 3, forming one point of the line running northerly from Commercial wharf, is on Long wharf on the line of the electric-wire poles on the south side of the wharf. From it the following angular readings are taken:

	°	′
Northwest corner of Commercial wharf, being the direction of this portion of the harbor line	4	19
Little Lime Rock spindle	9	14
Lime Rock light-house chimney	27	40
Redoubt Fort Adams (center observation tower)	46	9
Cupola of Old Colony storehouse (last building on north side of Long wharf)	82	51
Statehouse cupola	258	38
Southeast corner A. A. Barker's grain storehouse, distant 27.7 feet	172	40
Southwest corner Ernst Voight cold-storage building, distant 43 feet	217	36
North curb on Long wharf, distant 22.3 feet	172	40

Point No. 4, forming one point of line extending westerly south of Long wharf, is near the east line of the City wharf, 13.3 feet south of the line of Long wharf. From it the following angular readings are taken:

	°	′
On harbor line passing through this point	258	12
Hazard Memorial School building	270	51
Trinity Church spire	295	32
Shot tower	339	42
Cupola Old Colony storehouse (last house on north side of Long wharf)	93	14

Point No. 5, forming second point marking harbor line in conjunction with Point No. 4, is on the City wharf, near the highway department building and near the northwest corner of the platform scales. From it the following angular readings are taken:

	°	′
Point No. 4 and harbor line	258	12
Hazard Memorial School building (cross on top)	269	59
Trinity Church spire	293	40
Shot tower	338	3

Point No. 6, being the southerly point marking the line extending from Briggs's wharf to the causeway at Coasters Harbor Island; it is in a grass plat extending east from the foot of the city pier, and from it the following readings are taken:

To Point No. 7 on causeway, being the direction of this portion of the harbor line	°	′
	177	0
Zabriskie Memorial Church	183	47
City Hall dome	207	37
Trinity Church spire	210	55
Shot tower	229	58
Fort Adams flag pole	104	50
Rose Island light-house	141	26
Breakwater light-house	168	7
War College cupola	170	3

Point No. 7, being the northern point of the harbor line extending from Briggs's wharf to the causeway leading to Coasters Harbor Island, is situated on the stone wall forming the southerly side of the causeway, and is 175 feet to the eastward of the east abutment of the bridge in the causeway. The following angular readings are taken from it:

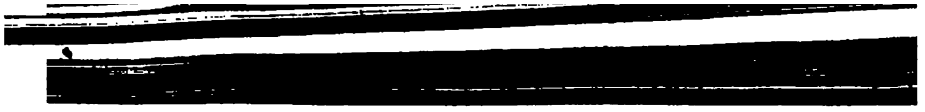
	°	′
Harbor line and Point No. 6	357	0
Lime Rock light-house (chimney)	2	21
Breakwater light-house	9	5
Lightning rod on machine shop, chimney on Training Station wharf	57	26
War College cupola	105	22
East end of south truss of bridge in causeway	103	18
Zabriskie Memorial Church	347	48

NOTE.—All of above points, except Point No. 7, are at present 2 by 3 inch stakes with tack driven flush with ground. Point No. 7 is roughly cut on top of one of the stones of the causeway wall, and is witnessed by a small cut in the top and bottom edge of the middle rail of the fence inclosing the causeway.

WAR DEPARTMENT, *August 28, 1901.*

Approved.

E. ROOT,
Secretary of War.



APPENDIX E.

IMPROVEMENT OF RIVERS AND HARBORS IN CONNECTICUT AND OF PAWCATUCK RIVER, RHODE ISLAND AND CONNECTICUT.

REPORT OF MAJ. CHAS. F. POWELL, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1902, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Pawcatuck River, Rhode Island and Connecticut.
2. New London Harbor, Connecticut.
3. Thames River, Connecticut.
4. Connecticut River below Hartford, Connecticut.
5. Harbor of Refuge, Duck Island, Connecticut.
6. Branford Harbor, Connecticut.
7. New Haven Harbor, Connecticut.
8. Construction of breakwaters at New Haven, Connecticut.
9. Harbor at Milford, Connecticut.
10. Housatonic River, Connecticut.
11. Bridgeport Harbor, Connecticut.
12. Saugatuck River and Westport Harbor, Connecticut.
13. Norwalk Harbor, Connecticut.
14. Five-Mile River Harbor, Connecticut.
15. Stamford Harbor, Connecticut.
16. Southport Harbor, Connecticut.
17. Greenwich Harbor, Connecticut.
18. Harbor at Coscob and Mianus River, Connecticut.

UNITED STATES ENGINEER OFFICE,
New London, Conn., July 30, 1902.

GENERAL: I have the honor to transmit herewith annual report of the works of river and harbor improvements in my charge for the year ending June 30, 1902.

Very respectfully, your obedient servant,

CHAS. F. POWELL,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

E 1.

IMPROVEMENT OF PAWCATUCK RIVER, RHODE ISLAND AND CONNECTICUT.

No work under the project was done during the year from lack of sufficient funds. It is proposed to apply the appropriation of June 13, 1902, to removing shoals in the channel across Little Narragansett Bay leading to the river, and to dredging downstream at the worst bars in the river channel from the point reached by the dredging of 1900.

Money statement.

July 1, 1901, balance unexpended	$92.78
Amount appropriated by river and harbor act approved June 13, 1902	9,000.00
	9,092.78
June 30, 1902, amount expended during fiscal year	4.38
July 1, 1902, balance unexpended	9,088.40
Amount (estimated) required for completion of existing project	161,361.60
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	15,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

March 3, 1871	$10,000.00	June 3, 1896	$15,000.00
June 10, 1872	10,000.00	March 3, 1899	15,000.00
March 3, 1873	10,000.00	June 13, 1902	9,000.00
June 23, 1874	10,000.00		137,400.00
March 3, 1875	10,000.00		
August 5, 1886	12,000.00	December 5, 1895, deposit to credit of the United States Treasurer	399.99
August 11, 1888	10,000.00		
September 19, 1890	16,600.00		
July 13, 1892	3,800.00		
August 18, 1894	6,000.00	Total	137,000.01

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1901.

[Furnished by Messrs. Maxson & Co., Westerly, R. I.]

Receipts and shipments by river from Westerly.

Articles.	Tons.	Articles.	Tons.
Coal	35,000	Brick	1,390
Sand	635	Miscellaneous	5,023
Iron	255		
Stone	500	Total	48,313
Lumber	5,510		

Number of passengers, 10,220.

Arrivals and departures of vessels during calendar year 1901, each entrance and departure being counted as one.

	Number.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam:			
Freight, mainly	140	7½	200
Passenger, mainly (estimated)	100	5½	80
Tugs	750	6	45
Sail:			
Freight	250	8	200
Fishing boats	1,300	3	9
Pleasure boats, large (estimated)	900	2½	6
Pleasure boats, small	850	2	3
Total	4,290		

E 2.

IMPROVEMENT OF NEW LONDON HARBOR, CONNECTICUT.

This is a new improvement, no project for this harbor as such having been adopted prior to the present one, which was authorized by the act of June 13, 1902. Some work under Thames River projects had been applied to dredging Shaws Cove and removal of bowlders in the vicinity of the Central Vermont Railroad dock. It is expected that the present appropriation of $25,000 will be expended in dredging a channel of project depth, but of less than project width, beginning at deep water off the Central Vermont dock and extending it to and along the portion of the dock front most used by deep-draft vessels as far as the available funds will permit under a continuing contract for completion of the full project, which does not include any maintenance or other work at Shaws Cove.

Money statement.

Amount appropriated by river and harbor act approved June 13, 1902	$25,000.00
July 1, 1902, balance unexpended	25,000.00
Amount (estimated) required for completion of existing project	120,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	60,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1901.

Foreign.

Value of imports	$18,514.84
Revenue receipts, duties on imports	1,945.27
Foreign vessels:	
Entered	10
Cleared	10
Total	20
Domestic vessels:	
Entered	6
Cleared	7
Total	13

Net tonnage of vessels owned at this port.

Kind of vessel.	Number.	Tons.
Steamers	46	13,984
Sailing vessels	85	14,138
Barges	23	5,316
Total	154	33,438

Vessels plying to and from the harbor.

[Compiled.]

Kind of vessel.	Number of round trips.	Aggregate tonnage of all trips.
Steamers (5 to 19)	665	2,778,300
Sailing (6 to 21½)	169	78,700
Barges (7½ to 20½)	392	221,000
Total	1,226	3,078,000

Receipts and shipments by coastwise vessels.

Articles.	Tons.	Articles.	Tons.
Coal	251,000	Building materials	4,700
Lumber	8,000	General merchandise	477,660
Petroleum and naphtha	7,330		
Fish	1,700	Total	750,390

E 3.

IMPROVEMENT OF THAMES RIVER, CONNECTICUT.

No improvement work was done during the year for lack of funds. It is proposed to apply $15,000, appropriated by act of June 13, 1902, as follows:

(*a*) To restore project depths in the crossover channel, below Allyns Point, and at Long Reach and Walden Island, above Allyns Point.

(*b*) To repair with riprap stone the Mohegan, Trading Cove, and Long Rocks dikes, requiring in the aggregate about 275 tons of stone.

(*c*) To secure by dredging project depths in the channel where now shoal, and then widen bar channels to project widths as far as funds permit.

Present traffic calls for a 20-foot channel at low water to accommodate coal vessels going to Allyns Point. Work under the present appropriation will restore and hold a low-water depth of 16 feet in this section of the river in accordance with the project.

Money statement.

July 1, 1901, balance unexpended		$303.24
Amount appropriated by river and harbor act approved June 13, 1902		15,000.00
		15,303.24
June 30, 1902, amount expended during fiscal year		228.92
July 1, 1902, balance unexpended		15,074.32
Amount (estimated) required for completion of existing project		34,100.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902:		
For works of improvement	$18,000.00	
For maintenance of improvement	2,000.00	
		20,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

March 3, 1821	$150	August 2, 1882	$35,000
March 2, 1829	150	July 5, 1884	25,000
July 4, 1836	10,000	August 5, 1886	22,500
July 7, 1838	10,000	August 11, 1888	50,000
March 3, 1837	20,000	September 19, 1890	20,000
June 23, 1866	10,000	July 13, 1892	30,000
March 3, 1867	72,000	August 18, 1894	12,500
March 3, 1871	15,000	June 3, 1896	12,000
June 10, 1872	10,000	March 3, 1899	20,000
June 18, 1878	10,000	June 13, 1902	15,000
March 3, 1879	12,000		
June 14, 1880	22,500	Total	463,800
March 3, 1881	30,000		

COMMERCIAL STATISTICS.

* * * * * * *

A freight steamer plies between Norwich and New York, and during summer a market steamer from Norwich to Long Island, and 3 passenger steamers to summer resorts on Long Island Sound. It is reported that several coal vessels loaded to 18 feet were towed with detention and under other difficulty at high tides during the fiscal year, 1902, to Allyns Point, and that vessels drawing 20 feet, and even more, would be used here if the channel permitted.

E 4.

IMPROVEMENT OF CONNECTICUT RIVER BELOW HARTFORD, CONNECTICUT.

On account of fillings in the channel, which by May was greatly impeding river traffic, notwithstanding the private dredging done by the Hartford and New York Transportation Company in the spring and summer of 1901, an emergency allotment of $2,000, act of June 6, 1900, was made May 24, 1902. Contract was made with lowest bidder of proposals previously advertised for, and the dredging begun May 31 under the plan of opening a narrow cut through controlling bars in the order of their degree of obstruction. The work was suspended June 21, on account of exhaustion of the allotment, and resumed June 29, when part of appropriation of June 13, 1902, became available. The following shows details of the dredging:

Dates.	Hartford Upper bar	Hartford Lower bar.	Clay Banks.	Pistol Point.	Remarks.
	Cubic yds.	*Cubic yds.*	*Cubic yds.*	*Cubic yds.*	
May 31–June 4				2,857	
June 5–12		6,766			
June 12–18	5,447				
June 18–20		2,910			
June 21–29					No dredging.
June 30			536		
Total	5,447	9,676	536	2,857	

Miscellaneous data.

	Feet.
Width of cut in all places	25
Depth of cut in all places except Clay Banks	10
Depth of cut at Clay Banks	11
Total length of cut at—	
Hartford Upper bar	[a]1,603
Hartford Lower bar	[a]2,330
Clay Banks	150
Pistol Point	871

Nature of material dredged, small gravel at Upper Hartford bar; sand at other places.

It is expected to apply $10,000 of available balance in continuation of the river channel dredging this season, including similar work at cost of not over $1,000 at mouth of Salmon River, as authorized by the appropriation act, and to use the remainder of the funds for dredging after the spring freshets of 1903, and for work at Hartford dike and jetties at mouth of the river.

Money statements.

GENERAL IMPROVEMENT.

July 1, 1901, balance unexpended		$326.40
Amount appropriated by river and harbor act approved June 13, 1902		30,000.00
		30,326.40
June 30, 1902, amount expended during fiscal year		250.95
July 1, 1902, balance unexpended		30,075.45
July 1, 1902, outstanding liabilities		535.38
July 1, 1902, balance available		29,540.07
Amount (estimated) required for completion of existing project		100,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902:		
For works of improvement	$30,000.00	
For maintenance of improvement	10,000.00	
		40,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

EMERGENCIES IN RIVER AND HARBOR WORKS (ACT OF JUNE 16, 1900) FOR CONNECTICUT RIVER BELOW HARTFORD, CONN.

May 24, 1902, amount allotted	$2,000.00
June 30, 1902, amount expended during fiscal year	132.98
	1,867.02
June 30, 1902, outstanding liabilities	1,867.02

[a]Approximately.

APPROPRIATIONS.

July 4, 1836	$20,000.00	August 2, 1882	$45,000.00
March 1, 1843	3,471.57	July 5, 1884	35,000.00
July 11, 1870	20,000.00	March 3, 1885	4,745.43
March 3, 1871	35,000.00	August 5, 1886	26,250.00
June 10, 1872	40,000.00	August 12, 1888	10,000.00
March 3, 1873	20,000.00	September 19, 1890	12,500.00
June 23, 1874	20,000.00	July 13, 1892	20,000.00
March 3, 1875	20,000.00	August 18, 1894	20,000.00
August 14, 1876	20,000.00	June 3, 1896	20,000.00
June 20, 1878	4,203.00	March 3, 1899	20,000.00
June 18, 1878	30,000.00	June 13, 1902	30,000.00
March 3, 1879	10,000.00		
June 14, 1880	10,000.00	Total	526,170.00
March 3, 1881	30,000.00		

CONTRACT IN FORCE.

Name of contractor: Hartford and New York Transportation Company.
Date of contract: June 12, 1902.
Date of approval: Emergency contract.
Work begun: May 31, 1902.
Character of contract: Dredging bars.
Rate: 11.9 cents per cubic yard.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1901.

Statement of G. E. Verrill, junior engineer, Engineer Department.

Nearly all freight at Saybrook is received and shipped from the docks of the New York, New Haven and Hartford Railroad Company. Have been unable to obtain statement from this company.

The following freight was in addition to that received at the railroad dock:

	Quantity.	Value.
	Tons.	
Six schooner loads of soft coal to H. Potter & Son	1,000	$5,750
Two barge loads of coal to J. Kellogg & Son:		
Soft coal	100	350
Hard coal	700	3,955
Total	1,800	10,055

New line of transportation established during last summer for about three months, making seven trips per week, averaging 75 passengers per trip. No freight carried.

A market boat, steamer *Holyoke*, runs to and from Orient, Long Island, and Saybrook, Connecticut River, making three trips per week for about six months during the summer and fall, carrying farm produce, etc. Regular steamer from Hartford to New York stops at Saybrook. All freight by these two lines is received and discharged at the railroad wharf.

Only a few vessels now come in for a harbor, as most of them now go behind Duck Island breakwater.

The following gives the quantity of petroleum products received at the Connecticut water stations of the Standard Oil Company during 1901:

Station.	Quantity.		Estimated value.
	Gallons.	*Tons.*	
Wilson Point	21,577,911	70,128	$1,294,700
New Haven	1,583,443	5,146	103,923
New London	1,923,662	6,251	125,650
Bridgeport	522,588	1,698	33,968
Greenwich	17,290	56	1,210
Stamford	25,884	84	1,811
Stony Creek	4,358	14	310

All shipments made from the above points after receipt of the goods are to inland points. No shipments made by water.

Respectfully submitted.

G. E. VERRILL, *Junior Engineer.*

LETTER FROM C. C. GOODRICH, GENERAL MANAGER HARTFORD AND NEW YORK TRANSPORTATION COMPANY.

HARTFORD LINE,
Hartford, Conn., May 8, 1902.

MY DEAR SIR: In answer to yours of the 1st instant, I send you herewith a close estimate of the commerce of Connecticut River for the year 1901.

Freight received for all river landings:		
Coal to all landings and for use of steamers	tons..	385,000
Stone, including paving and flags	do...	40,000
Lumber, yellow pine	feet..	2,000,000
Spruce and lath	do...	1,000,000
Chestnut and oak lumber	do...	500,000
Lime, cement, brick, tile, and pipe, etc., in cargoes	tons..	10,000
Merchandise freight by steamers (daily)	do...	85,000
Freight forwarded from river landings:		
Stone in cargoes	tons..	60,000
Chestnut lumber, ties, and posts	do...	20,000
Telegraph poles and piles	do...	5,000
Firewood, chestnut, oak, and hickory	do...	10,000
Merchandise freight by steamers (daily)	do...	30,000
Estimated arrivals of steamers of all classes, except pleasure yachts		450
Sailing vessels, except yachts		225
Barges and scows, in tow		760

Steamer *Falcon* ran daily between Hartford and Saybrook Point during pleasure travel season, carrying passengers only.

Steamer *Waiontha* ran part of season between Hartford, New London, and Crescent Beach, carrying passengers only.

Above 50 yachts, belonging to private parties, were engaged in passenger travel, either public or private, during the season.

During months of spring freshets barges load to 13 feet draft to points between Saybrook and Hartford. This is the outside available depth of water, as freshet does not affect the river between the jetties at Saybrook. The dredging necessary to make the river available for commerce, drawing 9 feet at low water, was done by this company in 1901, owing to lack of funds for that purpose in hands of the Government.

The commerce and size of vessels has more than doubled, owing to improvements by the Government, and will be still more greatly benefited when the dike at Hartford bar is completed, the jetties at Saybrook further strengthened, and sand removed, which has drifted in, and which much narrows the channel at the outer section.

Yours, respectfully,

C. C. GOODRICH,
General Manager.

Maj. C. F. POWELL.

E 5.

IMPROVEMENT OF HARBOR OF REFUGE, DUCK ISLAND, CONNECTICUT.

No operations were conducted from lack of funds. Of three projected breakwaters, one has been built substantially to full length; the portion made in 1898 has settled and needs retopping.

No record is kept of the number of vessels passing or seeking this refuge; the former is judged to be about two-thirds of the number passing New Haven breakwater, which for nine months of calendar year 1901 was recorded as 32,283. Duck Island is about midway from New Haven to New London. During year 1900, 1,707 vessels were reported as seeking Duck Island Harbor for refuge.

Money statement.

July 1, 1901, balance unexpended	$93.60
June 30, 1902, amount expended during fiscal year	50.21
July 1, 1902, balance unexpended	43.39
Amount (estimated) required for completion of existing project	349,540.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	25,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

September 19, 1890	$25,000
July 13, 1892	35,000
August 17, 1894	30,000
June 3, 1896	24,000
June 6, 1900 (allotment)	202
Total	114,202

E 6.

IMPROVEMENT OF BRANFORD HARBOR, CONNECTICUT.

This is a new work, authorized by the act of June 13, 1902. An examination of the harbor has since been made. It is expected to apply available funds in dredging a channel between the lower and upper docks 8.5 feet deep, as per project referred to in the appropriation item, and 75 feet wide and as much wider up to the project width, 100 feet, as funds permit. It is also expected to let this work together with Milford Harbor in one contract, specifications for which have been prepared.

* * * * * * *

Money statement.

Amount appropriated by river and harbor act approved June 13, 1902 ..	$5,000.00
July 1, 1902, balance unexpended	5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902, for maintenance of improvement	250.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

E 7.

IMPROVEMENT OF NEW HAVEN HARBOR, CONNECTICUT.

Work under dredging contract in progress at beginning of the year was continued with short interruptions during the year; it was applied to widening the main channel previously dredged, from south end of the 16-foot anchorage basin upstream to the deep-vessel docks 750 feet below Tomlinson Bridge, and to developing the 12-foot and 16-foot basins. The following gives the work in more detail:

Location.	Cubic yards dredged.	Remarks.
Main channel:		
At lower end	39,534	Work in progress.
Opposite 16-foot basin	183,823	Completed.
At turn opposite Long wharf	295,410	Do.
In front of docks	137,306	Nearly completed.
Total for main channel.....	656,073	
12-foot basin	161,590	Completed.
16-foot basin	189,336	Work in progress.
Total for the year.....	1,006,999	
Total to date under present project and contract.	2,135,069	About 65 per cent of total estimated yardage of complete work.

It is proposed to apply the remaining balance to completion of the project of 1899 and the extension of the same to the Quinnipiac and Mill rivers below Grand avenue and to the basin east of Canal wharf, as authorized by the act of June 13, 1902.

Money statement.

July 1, 1901, balance unexpended		$82,257.20
Amount appropriated by sundry civil act approved June 28, 1902.....		67,000.00
		149,257.20
June 30, 1902, amount expended during fiscal year		46,781.83
July 1, 1902, balance unexpended		102,475.37
July 1, 1902, outstanding liabilities		22,644.48
July 1, 1902, balance available		79,830.89
July 1, 1902, amount covered by uncompleted contracts.....		69,115.87
Amount (estimated) required for completion of existing project.....		56,490.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902:		
For works of improvement.....	$45,100.00	
For maintenance of improvement	3,000.00	
		48,100.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of of the river and harbor act of 1899.		

APPROPRIATIONS.

August 30, 1852	$6,000	August 5, 1886	$20,000
July 11, 1870	15,000	August 11, 1888	15,000
March 3, 1871	40,000	September 19, 1890	15,000
June 10, 1872	35,000	July 13, 1892	15,000
March 3, 1873	25,000	August 18, 1894	10,000
March 3, 1875	10,000	June 3, 1896	10,000
June 18, 1878	25,000	March 3, 1899	50,000
March 3, 1879	15,000	June 6, 1900	50,000
June 14, 1880	15,000	March 3, 1901	50,000
March 3, 1881	15,000	June 28, 1902	67,000
August 2, 1882	30,000		
July 5, 1884	10,000	Total	543,000

CONTRACT IN FORCE.

Name of contractor: John T. Regan, Chicago, Ill.
Date of contract: June 28, 1899.
Date of approval: July 20, 1899.
Work begun: December 8, 1899.
Character of contract: Continuing dredging.
Rates: Six cents per cubic yard within time limits; 3 cents thereafter.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1901.

[Furnished by committee on harbor, chamber of commerce, New Haven, Henry C. Rowe, chairman; amount of oyster traffic compiled by agents of United States Engineer Office, New London, Conn.]

Foreign:	
Value of imports	$195,699.78
Revenue receipts, duties on imports	51,611.44
Foreign vessels:	
Entered	46
Cleared	39
Total	85
Domestic vessels:	
Entered	[a] 2,916
Cleared	2,916
Total	5,832

Gross and net tonnage of vessels owned at this port.

	Number.	Gross tons.	Net tons.
Steamers	90	35,792	23,184
Sailing vessels	120	36,377	32,648
Barges	118	17,964	17,574
Total	328	90,133	73,406

[a] This covers only those vessels officially reported at the custom-house.

Arrivals and departures of vessels.

[Draft, 6 to 22 feet; tonnage, 100 to 2,600 tons.]

Kind of vessel.	Number of round trips.	Aggregate tonnage of all trips.
Steamers of all kinds	14,330	3,252,000
Sailing vessels	7,080	4,770,000
Barges in tow, scows, etc	8,700	4,070,000
Total	30,110	12,092,000

Freight received and shipped, coastwise only.

Chief articles.	Tons.	Estimated value.
Coal received:		
Bituminous	741,000	$2,529,650
Anthracite	542,508	2,612,163
Iron received and shipped	187,000	5,610,000
Lumber received (82,000,000 feet)	123,000	1,190,000
Oysters received and shipped	113,541	1,953,350
Miscellaneous merchandise:		
Received	1,080,000	120,800,000
Shipped	950,000	141,800,000
Total	3,737,049	276,495,163

Vessels employed in oyster traffic.

Class.	Tonnage.	Draft.	Number of round trips (estimated).
		Feet.	
Steamers (about 30)	10–230	3– 9.5	5,825
Schooners	50–150	4–10.5	452
Barges and scows	200–450	7– 9.5	164
Small sailing craft	5– 50	1– 4	2,762
Total			9,203

Mr. Rowe stated that "the figures covering the value of foreign imports and revenue receipts, together with the arrival and departure of vessels, is, of course, reliable and definite. I am indebted to Mr. J. Rice Winchell, deputy collector of customs, for this valuable information. We have not a definite record of the arrival and departure of vessels not entered at the custom-house, but add as reliable as we can secure.

"The estimate upon coal I regard as quite satisfactory, and I am largely indebted to Mr. W. S. Wells, of Williams, Wells & Co., for aiding on that item.

"As to the item of 'miscellaneous merchandise,' I find it impossible to get satisfactory information. The value of the miscellaneous freight carried on the New York boats is unknown, and it seems impossible to ascertain it. From the best authorities, however, that we have, it is estimated that the miscellaneous merchandise received and shipped is at least 5 per cent more than the same items for the year 1900. I have, therefore, added 5 per cent to the figures given for that year."

E 8.

CONSTRUCTION OF BREAKWATERS AT NEW HAVEN, CONNECTICUT.

No work of construction was conducted during the year from lack of sufficient funds to warrant resumption of operations. A light was maintained at the unfinished end of the west breakwater. The pro-

jected breakwaters will provide a harbor of refuge, furnish an outer anchorage for vessels bound to and from New Haven, and help protect the entrance to New Haven Harbor proper from seas and diminish channel filling. The works could readily be completed in at least four years. It is proposed to apply the funds in hand to repairs of the Ludington Rock and west breakwaters and to extension of the latter about 400 feet.

Money statement.

July 1, 1901, balance unexpended	$1,260.86
Amount appropriated by river and harbor act approved June 13, 1902.	44,000.00
	45,260.86
June 30, 1902, amount expended during fiscal year	695.47
July 1, 1902, balance unexpended	44,565.39
Amount (estimated) required for completion of existing project	1,272,134.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	300,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

March 3, 1879	$30,000	September 19, 1890	$120,000
June 14, 1880	30,000	July 13, 1892	120,000
March 3, 1881	60,000	August 18, 1894	125,000
August 2, 1882	60,000	June 3, 1896	100,000
July 5, 1884	40,000	June 13, 1902	44,000
August 5, 1886	75,000		
August 11, 1888	75,000	Total	879,000

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1901.

[Furnished by committee on harbor, Chamber of Commerce, New Haven, Henry C. Rowe, chairman.]

Vessels passing New Haven Breakwater.

Kind of vessel.	Mar.	Apr.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Revenue cutters	9			9	3	3	2		4
U.S. naval		2	11	3	1	2	3		
Light-house tenders	5	1	15	12	3	9	7	7	8
Steamers	1,371	1,739	2,093	1,467	1,077	851	906	845	619
Barks	2	5	2			2	1		
Brigs	5		2				1		1
Schooners	439	645	519	561	628	536	709	633	481
Sloops	150	232	300	247	282	266	169	55	23
Barges	1,052	1,031	1,397	1,209	1,114	891	1,121	1,092	1,009
Steamer yachts	4	9	151	239	173	134	51	11	1
Schooner yachts		1	101	187	100	101	34	1	
Sloop yachts	4	31	256	498	599	408	132	34	5
Miscellaneous		7	114				16	13	12
Unknown	23	47	6	37	119	86	209	248	187
Total	3,064	3,750	4,967	4,469	4,099	3,284	3,361	2,939	2,350

No reports received for January, February, and May.

Records given are not complete, as some vessels pass unobserved in the night or during thick weather.

E 9.

IMPROVEMENT OF HARBOR AT MILFORD, CONNECTICUT.

This is substantially a new improvement, authorized by the act of June 13, 1902. It is proposed to apply funds now available in completing the present project, and in preparation therefor an examination of channel and breakwaters was made; local harbor-line surveys were also conducted.

Money statement.

Amount appropriated by river and harbor act approved June 13, 1902 ..	$15,000.00
July 1, 1902, balance unexpended	15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902, for maintenance of improvement	500.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

June 10, 1872	$1,500	August 2, 1882	$5,000
June 23, 1874	5,000	August 11, 1888	5,000
March 3, 1875.....	13,000	September 19, 1890	2,500
June 18, 1878	10,000	June 13, 1902	15,000
June 14, 1880	5,000		
March 3, 1881.....	100	Total	62,100

E 10.

IMPROVEMENT OF HOUSATONIC RIVER, CONNECTICUT.

No operations of improvement work were conducted. Balance of funds on hand at beginning of the year was reserved for permanent works of the project, when with future appropriation available therefor the full amount would warrant an undertaking of the work. A special examination of a reported shoaling at Derby and upon a request for removal of the adjacent jetty at Sow and Pigs reef was made and reported upon adversely; an examination was also made of the breakwaters and of the channel from the river mouth to Derby. It is proposed to apply the appropriation of June 13, 1902, to reopening the channel of project depth, 7 feet, and 70 feet wide through Two-mile Island bar, and of same depth and 100 feet width through Crofuts, Drews, Camp Meeting, and Mill bars; to repair the breakwater, and use any remaining balance in dredging at the worst shoals below the Stratford bridges.

Money statement.

July 1, 1901, balance unexpended	$9,243.01
Amount appropriated by river and harbor act approved June 13, 1902...	10,000.00
	19,243.01
June 30, 1902, amount expended during fiscal year	226.70
July 1, 1902, balance unexpended	19,016.31
Amount (estimated) required for completion of existing project.....	37,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	20,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

March 3, 1871	$15,000	August 5, 1886	$5,000
June 10, 1872	15,000	August 11, 1888	35,000
March 3, 1873	10,000	September 19, 1890	35,000
June 23, 1874	10,000	July 13, 1892	20,000
March 3, 1875	5,000	August 18, 1894	25,000
June 18, 1878	5,000	June 3, 1896	25,000
June 14, 1880	2,000	March 3, 1899	15,000
March 3, 1881	2,000	June 13, 1902	10,000
August 2, 1882	2,000		
July 5, 1884	2,500	Total	238,500

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1901.

[For Stratford, port near river mouth, collected by agent of United States Engineer Office, New London. For Derby, at head of navigation, furnished by C. H. Fleming, harbor master, Bridgeport.]

STRATFORD, CONN.

Arrival and departure of vessels.

[Draft, 4 to 5½ feet; tonnage, 50 to 300 tons.]

Kind of vessel.	Tons.	Round trips.
Steamers	50	36
Schooners	50–100	34
Barges	300	8
Total		78

All of the above carried cargoes. Tugs and a large number of small sail and row boats, engaged in gathering shells and oyster seed, are not included above, as no record of them was kept.

Freight received by vessel.

Chief articles.	Tons.
Anthracite coal	2,500
Seed oysters (26,500 bushels)	716
Shells (76,000 bushels)	1,900
Total	5,116

Freight shipped by vessel.

Chief articles.	Tons.
Seed oysters (26,500 bushels)	716
Shells (76,000 bushels)	1,900
Total	2,616

DERBY, CONN.

Articles.	Tons.	Articles.	Tons.
Hard coal	29,857	Brick, paving	1,295
Soft coal	48,169	Brick, fire	235
Sand	1,863	Cement	11,600
Lumber	3,644	Water pipe, iron	39,500
Iron	1,410		
Bluestone	800	Total	136,373

REPORT OF MR. G. E. VERRILL, JUNIOR ENGINEER.

I have recently made a personal examination of the Housatonic River from the mouth up to Derby, and respectfully submit the inclosed report and project for improvement. Capt. Henry Schultheiss, one of the best pilots on the river, accompanied me and pointed out all the places that gave trouble to vessels navigating the river. My thanks are due to Capt. Joseph Green, who kindly furnished a tug and sent Captain Schultheiss with me, without expense to the United States.

The following report is based on an examination made June 25, 1902, on a rising tide, the gauge at the inner beacon, Bridgeport Harbor, reading 4.2 when sounding was commenced and 6.8 (high tide) when the examination was completed. All soundings have been reduced to mean low water at the point where taken, considering that the mean rise and fall of tide is 6.2 feet at the mouth of the river, 4.8 feet at the Stratford docks, and 4.2 feet at Derby, and that between these points the decrease in rise and fall is proportionate to the distance. The difference in time of tide between the mouth and Derby is considered to be about one and one-half hours.

The channel is in bad condition, especially at the bars above the railroad bridge, so that very little more than 4 feet at mean low water can be carried through to Derby, and even this draft can not be carried by loaded barges or scows, as the channel in many places is very narrow and it is difficult to keep in the best of water. The condition of each bar or shoal from the mouth up is as follows:

Outer bar, along the breakwater.—The condition of this bar is not bad, there being only one small place where the depths are less than 7 feet at mean low water. The minimum depth on this place is 5.5 feet, but only for a very short distance. This bar gives comparalively little trouble, and a small amount of dredging, perhaps 2,000 yards, would probably be sufficient.

Mary Anns bar, opposite Bull Run channel.—This place has given some trouble, the depths being quite uniform for some distance and the channel rather narrow, so that vessels rub badly on the bottom and a small amount of dredging, if available funds permit, would be a decided advantage, but it is not nearly as bad as the bars farther up stream. The minimum depth of this bar is 6 to 6.5 feet.

Above dike, from first buoy above dike to point 1,000 feet above dike.—The minimum depths here are above 5.7 feet at low tide, but the bottom is uneven and the total distance where shoals occur probably does not exceed 500 feet. Not very much trouble is experienced here and but little dredging would be required.

First turn above Nells Island.—A stretch along here, perhaps 1,500 feet long, shows several places where depth is about 6.8 feet, but it is not in bad condition and will probably require no dredging.

Mill bar, upper end.—The upper end of this bar, for a distance of about 700 feet, is shoal, the minimum depth found being 5.2 feet, and a number of soundings show less than 6 feet. There is also a place opposite Popes Flat, just below Mill bar, which is slightly shoal (6.6 feet) and gives some trouble, but probably not enough to warrant dredging, in view of other places so much worse. Mill bar should be dredged to full project depth and width where shoal.

Camp-Meeting bar.—The condition of this bar is bad, it being shoal for a distance of perhaps 800 feet, and the maximum that can be carried across it at low tide is less than 5 feet (minimum depth, 4.8 feet). It should be dredged to full project width and depth.

Drews bar.—This and the following bar are now the worst on the river. The minimum depth here is 4.3 feet, and for a considerable distance the depths are less than 5 feet. The total distance where depths are less than 7 feet is probably 1,500 to 2,000 feet. This bar should be dredged to full project width and depth.

Crofuts or Moulthrons bar.—More trouble is said to be experienced here than anywhere else, it not only being very shoal, but the channel is also very narrow. The minimum depth found in the best water was 4.4 feet. The total length of shoal is probably less than 1,000 feet. This should be dredged to full project depth and width.

Two Mile Island bar, upper end.—Starting about abreast the center of Two Mile Island, this shoal extends about 1,500 feet upstream, but is not very bad, the minimum depth being 5.3 feet, and most of the soundings ranging between 5½ and 6 feet. The upper part of this bar should be dredged to project depth, but the width might be somewhat decreased, and the amount of work need not be large.

Taking the river as a whole it may be said that, with the exception of Two-mile Island bar, the farther upstream the bar the worse its condition, and I would respectfully recommend that work be commenced at Two-mile Island bar, the operations there being reduced to the minimum, and then following downstream and taking the others in their order, including Mill bar. If available funds permit, a small amount

of dredging should be done on the outer bar, Mary Anns, and above the dike, taking these shoals in the above order. The work below the bridges is, however, not needed nearly as much as that above.

The material removed could probably all be put ashore to very good advantage, especially that from above the bridges.

It is extremely difficult, without an instrumental survey, to make a satisfactory estimate of the amount to be removed, owing to the necessity of estimating all distances by eye; but I have done the best I could, and think that the amount allotted for dredging is none too large, while on the other hand it should provide for a very fair channel from the mouth to Derby, even if not of full project dimensions all the way. The fact that the freshets during the past two years have been particularly high, that of last spring being especially so, probably accounts for the unusual amount of dredging required.

Breakwater, at mouth.—The inshore portion of the breakwater, being built only to about half tide level, was covered with water when I was there and I could make no satisfactory examination, but I was told that it was in good condition with the exception of that portion at the crossing of the Bull Run channel, where it has settled considerably. This portion has been rebuilt at least three times and has settled each time, and as it still serves its purpose of checking the shifting of the sand there would seem to be no necessity of rebuilding it, at least at present. The outer portion of the breakwater, built to above high water, is in fair condition. There is one place near the outer end that has settled, or the stones have been displaced, leaving a gap about 3 feet below the rest, and which would probably require about 150 tons of new stone to repair. There are also a number of small places here and there that need some new stones and trimming up of old ones. The total amount of new stone required to put it in good shape would probably be about 500 tons. There is no urgent necessity for this work, and it might well be left until after the dredging is completed, and then done, if it seems advisable and available funds permit.

The dike above is in good condition.

* * * * * * *

Very respectfully, yours,

G. E. VERRILL, *Junior Engineer.*

Maj. C. F. POWELL, *Corps of Engineers.*

E 11.

IMPROVEMENT OF BRIDGEPORT HARBOR, CONNECTICUT.

Dredging under continuing contract in force at beginning of the year was resumed April 7, 1902, and to the end of the year applied to connecting the 18-foot Bridgeport channel previously dredged downstream to the Naugatuck dock, with the deeper channel inside the inner beacon, 101,105 cubic yards; to partly developing the 18-foot anchorage basin, 30,562 cubic yards; and to removing the bluff sandy point at the gorge at Fancher's dock, of the Black Rock channel, 15,520 yards—aggregating 146,687 yards. There still remains 18,035 cubic yards of dredging under the first appropriation for the present project. The second appropriation is to be earned, according to the contract, at 2.5 cents per yard, the time limit for earning it at the base rate of 5 cents per yard having expired July 28, 1901. In addition to the contract work, portions of the harbor lines were identified at request of riparian owners, and permanently marked, and inspections made of permit structures and reported encroachments beyond harbor lines or encroachments on the channels by private parties.

It is proposed to apply the available balance in completing main channel work, in repair and extension of the breakwater and Black Rock jetties, and in dredging at the several branch channels, according to the project.

Money statement.

July 1, 1901, balance unexpended	$113,850.63
June 30, 1902, amount expended during fiscal year	6,849.32
July 1, 1902, balance unexpended	107,001.31
July 1, 1902, outstanding liabilities	4,586.37
July 1, 1902, balance available	102,414.94
July 1, 1902, amount covered by uncompleted contracts	102,414.94
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902, for maintenance of improvement	5,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

July 4, 1836	$10,000	July 5, 1884	$5,000
August 30, 1852	10,000	August 5, 1886	20,000
March 3, 1871	20,000	August 11, 1888	10,000
June 20, 1872	40,000	September 19, 1890	20,000
March 3, 1873	30,000	July 13, 1892	20,000
June 23, 1874	20,000	August 18, 1894	10,000
March 3, 1875	15,000	June 3, 1896	28,000
August 14, 1876	10,000	March 3, 1899	50,000
June 18, 1878	10,000	June 6, 1900	50,000
March 3, 1879	10,000	March 3, 1901	50,000
June 14, 1880	10,000		
March 3, 1881	10,000	Total	468,000
August 2, 1882	10,000		

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1901.

[Furnished by Mr. C. H. Fleming, harbor master, Bridgeport, Conn.]

Vessels arriving during the year, their tonnage, etc.:

Steamers		6,870
Schooners and sloops		5,630
Foreign vessels		46
Canal boats and barges		5,980
Bridgeport Steamboat Company, merchandise:		
To New York	tons	87,321
From New York	do	76,300

The following list of freight arrived during the year:

	Tons.		Tons.
Coal (hard)	427,502	Corn	9,856
Coal (soft)	253,000	Wood	815
Lumber (62,218,000 feet)	80,883	Cement	25,100
Iron	21,175	Iron pipe	15,570
Ground plaster	3,300	Fertilizer	1,185
Lath	1,207	Fire clay	5,460
Flagstone	41	Oyster shells	32,080
Feed	5,100	Asphalt	75
Steel	3,622	Shingles	15,000
Plumbago	10,030	Machinery	150
Cork	2,203	Copper ore	3,540
Scrap iron	12,000	Sulphur	1,010
Turnips	29	Vitriol	57
Logwood	2,000	Cable wire	280
Powder	977	Oysters	850
Oil	3,384	Trap rock	550
Brick	15,845		
Bluestone	2,570	Total	968,201
Sand and gravel	11,755		

Number of vessels repaired here during year:

Steamers	144
Schooners	37
Lighters	27
Sloops	165
Total	373

E 12.

IMPROVEMENT OF SAUGATUCK RIVER AND WESTPORT HARBOR, CONNECTICUT.

No work of improvement was conducted during the year from lack of sufficient funds. Completion of the project requires further removal of bowlders and dredging to full project dimensions at the channel opposite Westport.

Money statement.

July 1, 1901, balance unexpended	$526.70
June 30, 1902, amount expended during fiscal year	350.00
July 1, 1902, balance unexpended	176.70
Amount (estimated) required for completion of existing project	5,000.00

APPROPRIATIONS.

May 20, 1826	$400	March 2, 1867	$2,500
March 2, 1827	1,500	July 11, 1870	2,500
April 30, 1830	28	July 13, 1892	7,000
July 4, 1836	1,000	August 17, 1894	3,000
Do	3,000	June 3, 1896	3,000
May 3, 1837	3,734		
July 7, 1838	4,782		32,444

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1901.

[Collected by agent of United States engineer office, New London, Conn.]

Arrival and departure of vessels.

[Draft, 6 to 10 feet; tonnage, 200 to 300 tons.]

Kind of vessel.	Round trips.
Steam barges and canal boats	42
Schooners	2
Barges and canal boats	35
Total	79

All of above vessels carried cargoes. Tugs and small sailing craft are not included, as no record was kept of these.

Freight received by vessel.

Chief articles.	Gross tons.	Estimated value.
Anthracite coal	6,900	$33,400
Bituminous coal	2,096	6,788
Sawn lumber (180,266 feet B. M.)	280	3,500
Brick (175,000)	350	1,275
Bluestone flagging	125	600
Cement	35	300
Merchandise, via Allen's Line from New York:		
300 casks of skins	225	100,000
1,000 barrels naphtha	150	5,000
Dyeing and tanning material	100	10,000
1,000 barrels cement	165	1,000
Groceries	300	30,000
Miscellaneous	100	2,800
Total	10,826	194,743

Freight shipped by vessel.

Chief articles.	Gross tons.	Estimated value.
Merchandise, via Allen's Line to New York, 31,000 barrels farm produce	2,800	$102,500

A steam-barge line (Allen's) makes weekly trips to New York.

E 13.

IMPROVEMENT OF NORWALK HARBOR, CONNECTICUT.

No work of improvement was conducted during the year from lack of sufficient funds. Harbor-line surveys and an examination of the harbor were made. A project was prepared for resumption of operations.

The act of June 13, 1902, places this improvement in the consolidated item of five certain harbors in Connecticut between the Housatonic River and the New York State line.

It is expected to apply the allotment of funds which may be made to dredging for making the full project depth from outer end of the entrance channel to the railroad bridge, with such widening at turns and elsewhere as the project requires and funds permit.

Money statement.

July 1, 1901, balance unexpended	$164.25
June 30, 1902, amount expended during fiscal year	104.00
July 1, 1902, balance unexpended (transferred to consolidated works)	60.25

APPROPRIATIONS.

June 10, 1872	$10,000	July 5, 1884	$5,000
March 3, 1873	10,000	August 5, 1886	3,000
June 23, 1874	10,000	August 11, 1888	3,000
March 3, 1875	7,000	September 19, 1890	4,000
June 18, 1878	6,000	August 18, 1894	15,000
March 3, 1879	10,000	June 3, 1896	10,000
June 14, 1880	5,000	March 3, 1899	2,000
March 3, 1881	5,000		
August 2, 1882	5,000	Total	110,000

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1901.

[Collected by agent of United States Engineer Office, New London, Conn.]

Arrival and departure of vessels.

[Draft, 3 to 12 feet; tonnage, 30 to 900 tons.]

Kind of vessel.	Round trips.
Steamers of all kinds, except tugs	341
Tugs towing barges, etc. (estimated)	300
Sailing vessels	107
Barges and canal boats	312
Total	1,060

The above does not include frequent trips made by about 30 steamers (aggregating about 1,050 gross tons and ranging from 10 to 125 gross tons register), and about 50 small sailing craft (mostly sloops) engaged in oyster industry. A number of other oyster vessels also visit the harbor occasionally.

Freight received by vessel.

Chief articles.	Gross tons.	Estimated value.
Anthracite coal	48,546	$243,180.00
Bituminous coal	27,527	94,887.01
Sawn lumber (4,345,702 feet B. M.)	5,758	75,737.08
Laths (1,583,100)	331	3,841.72
Shingles (950,000)	127	2,812.00
Brick, building (800,000)	1,620	3,850.00
Stone, building	1,560	8,500.00
Cement and plaster	1,536	7,762.00
Sand, building	2,960	2,356.00
Sand, molding	1,081	1,591.00
Pig iron	1,255	18,976.00
Oysters, clams, etc. (214,745 bushels)	7,377	155,754.38
Miscellaneous	1,600	11,200.00
Receipts other than by New York boat	101,278	630,447.19
Merchandise via steamboat from New York	30,000	3,500,000.00
Total	131,278	4,130,447.19

Freight shipped by vessel.

Chief articles.	Gross tons.	Estimated value.
Seed oysters, shells, etc	886	$8,760.00
Stone	2,000	1,500.00
Wood	450	1,750.00
Merchandise, via steamboat to New York:		
Silex	5,400	100,000.00
Oysters	4,000	100,000.00
Miscellaneous	6,000	1,000,000.00
Total	18,736	1,212,010.00

A line of freight steamers, comprising three boats, is in operation, making daily trips between Norwalk and South Norwalk and New York.

E 14.

IMPROVEMENT OF FIVE-MILE RIVER HARBOR, CONNECTICUT.

No work of improvement was conducted during the year from lack of sufficient funds. Examination of the harbor was made and a project prepared for resumption of operations.

The act of June 13, 1902, places this improvement in the consolidated item of five certain harbors in Connecticut between the Housatonic River and the New York State line.

It is expected to apply the allotment of funds which may be made in dredging the existing channel 60 feet wide to the project depth of 8 feet to the turn above Fairview Hotel, or part way to the head of the harbor, and in widening and deepening the channel to project dimensions from its lower part as far upstream as funds permit.

Money statement.

July 1, 1901, balance unexpended	$58.41
July 1, 1902, balance unexpended (transferred to consolidated works)	58.41

APPROPRIATIONS.

August 11, 1888	$5,000	June 3, 1896	$2,500
September 19, 1890	5,000	March 3, 1899	2,500
July 13, 1892	5,000		
August 18, 1894	2,500	Total	22,500

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1901.

[Collected by agent of United States Engineer Office, New London, Conn.]

Arrival and departure of vessels.

[Draft, 2 to 10 feet; tonnage, 5 to 225 tons.]

Kind of vessels.	Round trips.
Steamers, mainly oyster boats	1,000
Sailing vessels, mainly small oyster sloops	7,500
Barges	25
Total	8,525

The above is an estimate based on the best information obtainable, as no record is kept, and includes the frequent trips made by about 10 steamers and 30 to 40 sailing craft engaged in the oyster industry.

Freight received by vessel.

Chief articles.	Gross tons.	Estimated value.
Anthracite coal	4,000	$24,000
Bituminous coal	800	2,400
Oysters and clams (358,500 bushels)	9,778	188,750
Oyster shells (155,000 bushels)	3,875	14,000
Total	18,453	229,150

Freight shipped by vessel.

Chief articles.	Gross tons.	Estimated value.
Oysters and clams (362,000 bushels)	9,947	$189,000

E 15.

IMPROVEMENT OF STAMFORD HARBOR, CONNECTICUT.

No work of improvement was conducted during the year from lack of sufficient funds. Examination was made in the early summer of rock obstructions in the east branch, and proposals invited for their removal; the only offer received was rejected, as the cost was too high. Subsequent examination of the remainder of the harbor was made and a project prepared for operations under expected allotment from the new appropriation. Surveys concerning the harbor lines and waterway encroachments were made.

The act of June 13, 1902, places this improvement in the consolidated item of five certain harbors in Connecticut between the Housatonic River and the New York State line.

It is expected to apply the available balance and funds which may be allotted for removing the rock obstructions to 1 foot below project depth and in dredging the channel to full project depth and width from its outer end upstream as far as funds permit.

Money statement.

July 1, 1901, balance unexpended	$1,234.33
June 30, 1902, amount expended during fiscal year	629.80
July 1, 1902, balance unexpended (transferred to consolidated works)	604.53

APPROPRIATIONS.

August 5, 1886	$10,000	June 3, 1896	$10,000
August 11, 1888	5,000	March 3, 1899	6,000
September 19, 1890	5,000		
July 13, 1892	15,000	Total	61,000
August 18, 1894	10,000		

E 16.

IMPROVEMENT OF SOUTHPORT HARBOR, CONNECTICUT.

* * * * * * *

Examination of the harbor and breakwaters with reference to the new improvement authorized was made, and a project prepared for operations.

* * * * * * *

APPROPRIATIONS.

March 2, 1829	$6,097.00	August 14, 1876	$5,000.00
July 3, 1832	4,490.23	June 14, 1880	2,500.00
July 4, 1836	1,500.00	March 3, 1881	2,500.00
March 3, 1837	1,000.00	August 2, 1882	3,000.00
July 11, 1870	Unknown.		
March 3, 1875	5,000.00	Total	31,087.23

E 17.

IMPROVEMENT OF GREENWICH HARBOR, CONNECTICUT.

No work of improvement was conducted during the year from lack of sufficient funds. Inspections as to harbor lines and waterway encroachments were made; also examinations of the harbor for preparing a project for resumption of improvement operations.

The act of June 13, 1902, places the harbor in the consolidated item of five certain harbors in Connecticut, between the Housatonic River and the New York State line.

It is expected to apply the available balance and funds which may be allotted in dredging the channel 90 feet wide and 9 feet deep, project dimensions, from its outer end to the steamboat dock, and in widening the channel previously dredged upstream therefrom, also deepening it to 6 feet, the project depth, where shoal, to completion or as far as funds permit.

Money statements.

GREENWICH HARBOR.

July 1, 1901, balance unexpended	$851.55
June 30, 1902, amount expended during fiscal year	381.57
July 1, 1902, balance unexpended (transferred to consolidated works)	469.98

CONSOLIDATED: NORWALK, FIVE-MILE RIVER, STAMFORD, SOUTHPORT, AND GREENWICH HARBORS.

July 1, 1901, balance (received from the separate works)	$2,308.54
Amount appropriated by river and harbor act approved June 13, 1902	44,000.00
	46,308.54
June 30, 1902, amount expended during fiscal year	1,115.37
July 1, 1902, balance unexpended	45,193.17
Amount (estimated) required for completion of existing projects	137,700.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	70,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATIONS.

Greenwich Harbor.

June 3, 1896	$6,000

Consolidated: Norwalk, Five-mile River, Stamford, Southport, and Greenwich harbors.

June 13, 1902	$44,000

COMMERCIAL STATISTICS FOR GREENWICH HARBOR, CALENDAR YEAR 1901.

[Furnished by Mr. Joseph Brush, merchant at Greenwich.]

Arrival and departure of vessels.

[Draft, 4 to 14 feet; tonnage, 30 to 700 tons.]

	Number of trips.
Steamer Maid of Kent, passenger and freight line to New York, making daily trips	315
Sailing vessels: Schooners, brigs, sloops, etc. (estimated)	350
Steam barges, steam canal boats, steam lighters, etc	175
Coal and other barges (in tow of tugs), 3 to 5 weekly	250

Freight received and shipped by water.

Coal, lumber, brick, cement, plaster, lime, quarried stone, crushed stone, cut stone, gravel, trap rock, gasoline launches and engines, grain, hay, straw, apples, potatoes, and other farm produce and general merchandise, all estimated at 350,000 tons; general freight by steamer *Maid of Kent* (150 to 175 tons each trip) estimated at 50,000 tons.

A detailed statement was promised, but has not yet been received. The above estimate of tonnage and vessels except as to the steamer *Maid of Kent* is judged to be a very sanguine one.

E 18.

IMPROVEMENT OF HARBOR AT COSCOB AND MIANUS RIVER, CONNECTICUT.

No improvement operations were conducted and none are expected from lack of funds. The completion of the project requires the dredging of the remaining half of the 7-foot turning basin and for extension of the 6-foot channel 100 feet wide up the harbor to its head, about half a mile, and where present depths are about 2 feet.

Money statement.

July 1, 1901, balance unexpended	$170.31
June 30, 1902, amount expended during fiscal year	100.00
July 1, 1902, balance unexpended	70.31
Amount (estimated) required for completion of existing project	35,000.00

APPROPRIATIONS.

July 13, 1892	$7,000
August 18, 1894	4,000
June 3, 1896	8,000
Total	19,000

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1901.

[Collected by agent of United States Engineer Office, New London, Conn.]

Arrival and departure of vessels.

[Draft, 4 to 7 feet; tonnage, 13 to 250 tons.]

Kind of vessel.	Round trips.
Oyster steamers	200
Tugs towing barges (2 trips for each barge)	42
Barges	21
Total	263

The above does not include the trips made by small sail and power boats. The railroad drawbridge below Coscob was opened 546 times during the year for passing vessels, mainly oyster steamers and small sailboats. The Riverside Yacht Club, owning a good-sized fleet of yachts, has its headquarters just below the railroad bridge.

Receipts by vessel.

Chief articles.	Gross tons.	Estimated value.
Anthracite coal	4,600	$23,000
Bituminous coal	933	2,738
Oysters and clams (33,000 bushels)	1,256	22,750
2 hulls of boats	5	2,000
Total	6,794	50,488

Shipments by vessel.

Chief articles.	Gross tons.	Estimated value.
Oysters and clams (32,000 bushels)	1,211	$21,500
26 boats and launches, built here	44	7,400
63 gasoline engines	13	9,450
Total	1,268	38,350

APPENDIX F.

IMPROVEMENT OF HUDSON RIVER AND HARBORS THEREON, OF HARLEM AND EAST RIVERS, AND OF WAPPINGER AND NEWTOWN CREEKS, NEW YORK.

REPORT OF COL. S. M. MANSFIELD, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1902, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Hudson River, New York.
2. Harbor at Saugerties, New York.
3. Harbor at Rondout, New York.
4. Harbor at Peekskill, New York.
5. Wappinger Creek, New York.
6. East River and Hell Gate, New York.
7. Harlem River, New York.
8. Newtown Creek, New York.

HARBOR LINES.

9. Hudson River at Troy, New York.
10. Hudson River at New Baltimore, New York.
11. East River at Steinway, New York, New York.
12. East River in front of Cob Dock, United States navy-yard, Brooklyn, New York.

UNITED STATES ENGINEER OFFICE,
New York City, July 14, 1902.

GENERAL: I have the honor to forward herewith annual report upon works of river and harbor improvements in my charge for the fiscal year ending June 30, 1902.

Very respectfully, your obedient servant,

S. M. MANSFIELD,
Colonel, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

F 1.

IMPROVEMENT OF HUDSON RIVER, NEW YORK.

At the beginning of the present fiscal year dredging, rock removal, and dike construction and repair was in progress under contracts with Kirk, Driscoll & Co. and James Du Bois. The dredging and rock

removal were continued under the same contractors throughout the year, with the exception of the winter months. The construction and repair of dikes was continued until July 31 under the contract with James Du Bois, when, owing to financial difficulties, his sureties, the United States Fidelity and Guaranty Company, took possession of the plant and material and continued the work, first as representatives of James Du Bois and then under a contract.

Dredging in continuance of the project and for the relief of navigation was carried on between a point south of Castleton and the State Dam at Troy, the following quantities having been removed from the localities named below and the spoil disposed of according to law:

	Cubic yards.
Nine Mile Tree cross-over	8,153
Castleton bar	20,621
Cedar Hill bar	14,928
Winnies bar	13,911
Stone Light shoal	18,435
Bogart Light shoal	6,281
In front of Albany	1,885
In front of arsenal	277
Arsenal to Congress street	2,552
Congress street to Broadway	2,066
Broadway to D. & H. bridge	29,808
D. & H. bridge to High dock	96,768
High dock to State Dam	16,326
Total	232,011

The removal of rock from the channel in front of Troy has been continued, and the following quantities have been broken up and removed:

Name of reef.	Area dredged.	Prism removed.
	Sq. feet.	*Cubic yds.*
Arsenal	47,000	1,285
Madison street	23,000	382
Jefferson street	121,200	2,489
Adams street	116,650	5,268
Congress street	5,400	206
Hoosick street	12,000	428
Jay street	15,000	1,799
Total	340,250	11,957

The progress in the construction and repair of dikes has been very far from satisfactory even since the transfer of the contract, but the present contractors are making preparations to push the work when the tides are low enough, and have prepared machinery for working on the placing of timber during all stages of the tide, which as yet has not worked satisfactorily.

The following shows the total quantities of materials put in place and secured during the fiscal year:

Pine piling	linear feet	38,206
Sheet piling	feet B. M.	126,220
Round timber	linear feet	3,854
Square timber	feet B. M.	39,973
Tie-rods and screw bolts	pounds	15,215
Driftbolts and washers	do	4,925
Rubblestone	cubic yards	7,166
Quarry spalls	do	77

The only new dike under construction, that extending in front of Mulls Plaat, which was unfinished at the end of the last fiscal year, is still practically in the condition in which it was one year ago

Repairs to existing dikes are in progress; the plans for the work, which vary according to the conditions existing at each particular dike, have been so designed as to make as permanent a structure as can be made where timber is used, and in every case sufficient new piling has been driven to give a good anchorage for new work. The localities where work has been done are shown in the following table:

Name of dike.	Character of work.	Length of dike repaired.
		Lin. ft.
Mulls Island	Full repairs	2,600
Barren Island	do	500
Middle dike	New waling and rubble, with a few piles.	2,680
Upper Schodack half	Full repairs	720
Nine-Mile-Tree half	do	550
Castleton (New York State)	do	990
Cedar Hill (Poplar Island)	do	1,380
Cow Island	do	1,760
Campbell Island	do	1,520
Bath	do	3,270

Rubblestone, quarry spalls, and broken rock excavated from the channel at Troy, N. Y., have been used for repairing and strengthening old pile dikes and protecting the footing course of paved dikes at the following localities, viz:

Name of dike.	Rubblestone.	Quarry spalls.	Broken stone.	Length of dike filled.	Cost of material.
	Cu. yds.	*Cu. yds.*	*Cu. yds.*	*Lin. ft.*	
Coxsackie Island	526			100	$420.80
Bronk Island	219			500	175.20
Willow Island			410	500	246.00
Mulls Plaat dike extension		77	196	700	179.20
Barren Island	140			500	112.00
Upper Schodack Island half			225	400	135.00
Castleton (United States)	66			100	52.80
Cedar Hill	917			2,000	733.60
Campbell Island	839			4,000	671.20
Overslaugh No. 2	681			900	544.80
Beacon Island paved dike	54			50	43.20
Papscanee Dike:					
Section II, extension	251			1,437	200.80
Section II	74			200	59.20
Section I, extension	77			817	61.60
Section I	150			2,200	120.00
Overslaugh No. 1	164			150	131.20
Douws Point dike extension	195			1,150	156.00
Bath	445			2,000	356.00
Patroons Lower Island (paved)	237			650	189.60
Patroons Island revetment	125			150	100.00
Base Island (paved)	671			950	536.80
Hillhouse Island revetment	125			300	100.00
Breaker Island half	50		113	900	107.80
Breaker Island revetment	487			700	389.60
Fort Schuyler	69			150	55.20
Total	6,562	77	944	21,497	5,877.60

The mean low-water level at Albany and Troy was above that for several seasons past, and at Albany as much as half a foot above the mean low-water plane established in 1876. The mean range of the tides was somewhat reduced, being 2.68 at Albany, 2.65 at Troy (foot of Broadway), and 1.55 at the State dam. The lowest tides recorded were 1.95 at Albany and 2.37 at foot of Broadway, Troy, below plane of reference of 1876. For the previous results of tidal records reference is made to Annual Report of Chief of Engineers for 1897, page 998, and 1900, page 1490.

Navigation closed for the season on November 30, 1901, heavy ice having formed, which broke up and moved out of the section between New Baltimore and Troy, December 12; but just below New Baltimore, at Stonehouse bar, an ice dam formed which remained unbroken all winter. March 1, 1902, after a quick thaw and warm rain, the ice, which was very solid and quite thick, suddenly started to move out, and after lodging for a short time at quite a number of places, formed a very dangerous dam and caused very high water above it, when it met the obstruction formed in December, which did a great deal of damage to the dikes and buildings in the vicinity, and also to the channel when it moved downstream.

Soundings taken since the opening of navigation show a very great change and deterioration of the channel through Coxsackie shoal and Stonehouse bar, and the formation of quite a bad shoal between Stuyvesant and the Upper Kinderhook light, the shoaling at Coxsackie being so bad as to form quite an obstruction to navigation. The tendency to shoal is also seen between Roah Hook and North Coeymans, on Nine-Mile-Tree-Cross-over, in front of Castleton, on Winnies bar and opposite Bogart light, and most of the extra depth obtained by dredging last year has disappeared. Generally below Albany the channel does not maintain the depth of 12 feet without frequent dredging, but between Albany and the foot of Broadway, Troy, with the exception of the Bath Cross-over, just north of the New York Central and Hudson River Railroad Company's freight bridge there are very slight changes from year to year, the depth of 12 feet being maintained with the width originally dredged of from 200 to 250 feet. The following table shows the width and depth of deepest navigable channel through the bars and shoals as compared with those of 1901:

[Feet.]

Locality.	1901.		1902.	
	Width.	Depth.	Width.	Depth.
Coxsackie shoal	20	12.0	50	10.5
Stonehouse bar	80	11.5	100	11.0
Willow Island shoal	270	12.0	300	12.0
Coeymans Cross-over	330	12.0	350	12.0
Roah Hook to North Coeymans	400	11.0	200	11.0
Mulls Cross-over	220	11.0	400	12.0
Nine-Mile Tree Cross-over	200	11.5	250	11.5
Castleton bar	320	11.5	150	11.0
Cedar Hill bar	110	11.0	200	11.5
Winnies bar	450	10.5	200	11.5
Stone Light shoal	175	12.0	300	11.5
Beacon Island shoal	20	12.0	400	12.0
Bogart Light shoal	220	12.0	60	12.0
Douws Point Cross-over	220	11.5	200	12.0
Cuyler bar	20	12.0	150	11.5
Through draws of bridge at Albany	110	12.0	110	12.0
Bath Cross-over	260	11.5	150	11.0
Bath shoal	180	12.0	200	12.0
Kellogg shoal	60	12.0	100	12.0
Fishhouse shoal	220	12.0	200	12.0
Round shoal	180	11.5	200	11.0
Covill Folly	110	12.0	150	12.0
Opposite Breaker Island	100	12.0	250	12.0
Van Buren bar	150	12.0	180	12.0
Washington bar	150	12.0	200	12.0
Front of Watervliet Arsenal	70	12.0	100	12.0
Arsenal to Congress street	210	12.0	300	12.0
Congress Street Bridge (draw)	80	12.0	100	11.5
Congress street to Broadway, Troy	150	12.0	400	11.0
Broadway to Delaware and Hudson Company's bridge	100	12.0	200	10.5
Delaware and Hudson Company's bridge (draw)	50	5.5	50	4.5
Delaware and Hudson Company's bridge to Hoosick street, Troy	50	5.5	100	10.0
Hoosick street to State dam	50	5.5	50	5.5

The above depths refer to the plane of mean low water established in 1876.

The removal of rock at Troy has improved the navigable channel, but the area in which the rock is found is so large that the contractors have not yet completed that work below the foot of Broadway. They are also breaking up and removing a very large reef, over which there has been only about 6 feet depth of water, from which but very little rock has been removed.

Under the contract now in force for removal of rock, it is contemplated to make a channel the full width and depth at the foot of Broadway, and to remove all material within the channel limits between the foot of Broadway and the State Dam—that is, above the depth of 9 feet below mean low water—except through the large reef of rock between Hoosick and Rensselaer streets, through which the width of the channel is to be 60 feet, and all rock removed to the depth of 12 feet.

The dredging required for this work is about completed as far as Hoosick street, but that between Rensselaer street and the State Dam is still to be done, and owing to the difficulty in dumping of the dredged material, which must be towed over the reef of rock below Rensselaer street, nothing can be done toward completing the dredging on this section while the plant is at work removing the rock from that reef.

The damage to the dike around the north end of Light-house Island, which was built in 1893, by the ice when breaking up, passing out this spring, has been very great; at least 250 linear feet of it is completely destroyed, and from several hundred feet more the stone is washed out. With the exception of about 300 feet of the dike around the north end of Coxsackie Island, which was more or less damaged and weakened by loss of stone filling, and a slight loss of stone filling from Bronk Island dike, the dikes passed through the spring break-up with slight damage. The necessity for several new dikes is very apparent, and that west of the channel through Coxsackie Shoal, which was mentioned in the report of 1898, page 1052, as required, though not in the original project, is shown to be a necessity by the present condition of the channel.

That the channel through Stonehouse Bar will not maintain itself in its present limits is very evident. The latest surveys show a tendency to open a channel to the westward, and not far from the line of the Bronk Island dike in the upper section. It is very evident that a dike must be built to the east of the present line of deepest water if the channel is to be maintained as located at present, but it would probably be more economical to change the location of the channel and dredge a new one farther west where the currents seem inclined to scour one for themselves.

The channel in front of Castleton, though dredged several times to the required depth, fills up again every spring. A comparison of the maps made from the soundings after dredging and the succeeding spring seem to indicate a great loss of velocity in the spring freshets after passing Cedar Hill, and a dropping of the material in suspension and consequent shoaling in the channel from the north end of Poplar Island to the south end of Castleton. This loss of velocity is occasioned by a large amount of water passing over the dike from the north end of Schermerhorn Island to Cedar Hill, and would seem to indicate the necessity for raising this dike at least 4 feet above the level of mean high water. A similar condition also exists between

Cabbage and Bogart islands, where there is a low dike, only to mean high-water level, for the channel opposite Bogart light will not keep its depth and width for more than a few months after dredging.

This improvement has been under the local charge of Mr. R. H. Talcott, assistant engineer, stationed at Albany.

The available balance and the appropriations recommended for fiscal year ending June 30, 1904, will be applied to continuing the excavation of the proposed channel, by means of dredging and rock removal, and for maintaining the channel already secured, by the removal of any shoals that may be formed by ice gorges or other causes.

To complete this work in a reasonable time and within the original estimate, contracts should be authorized for the balance of the work required under the project.

Money statement.

July 1, 1901, balance unexpended		$405,569.90
Amount appropriated by river and harbor act approved June 13, 1902		225,000.00
		630,569.90
June 30, 1902, amount expended during fiscal year		139,120.35
July 1, 1902, balance unexpended		491,449.55
July 1, 1902, outstanding liabilities		50,919.91
July 1, 1902, balance available		440,529.64
July 1, 1902, amount covered by uncompleted contracts		214,051.38
Amount (estimated) required for completion of existing project		1,040,356.44
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902:		
For works of improvement	$400,000.00	
For maintenance of improvement	25,000.00	
		425,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

By act of—	
June 30, 1834	$70,000.00
July 2, 1836	100,000.00
March 3, 1837	100,000.00
July 7, 1838	100,000.00
August 30, 1852	50,000.00
June 26, 1864, allotment	33,000.00
June 23, 1866	50,000.00
March 3, 1867	305,188.00
July 25, 1868, allotment	85,000.00
April 10, 1869, allotment	89,100.00
July 11, 1870	40,000.00
March 3, 1871	40,000.00
June 10, 1872	40,000.00
March 3, 1873	40,000.00
June 23, 1874	40,000.00
March 3, 1875	40,000.00
August 14, 1876	50,000.00
June 18, 1878	70,000.00
March 3, 1879	30,000.00
June 14, 1880	20,000.00
March 3, 1881	15,000.00
August 2, 1882	10,000.00

By act of—Continued.		
July 5, 1884	$30,000.00	
August 5, 1886	26,250.00	
August 11, 1888	75,000.00	
September 19, 1890	119,400.00	
		$1,667,938.00
September 19, 1890 (balance)	30,600.00	
July 13, 1892	187,500.00	
March 3, 1893	500,000.00	
August 18, 1894	145,000.00	
March 3, 1895	500,000.00	
June 11, 1896	480,000.00	
June 4, 1897	475,000.00	
July 1, 1898	160,406.56	
March 3, 1899	100,000.00	
June 6, 1900	400,000.00	
March 3, 1901	100,000.00	
June 13, 1902	225,000.00	
		3,303,506.56
Total		4,971,444.56

CONTRACTS IN FORCE.

Name of contractor: Kirk, Driscoll & Co.
Date of contract: June 28, 1899.
Date of approval: July 12, 1899.
Date of commencement: On or before July 27, 1899.
Date of completion: June 30, 1903.
For dredging, at rates of 19 cents and 24½ cents per cubic yard, and for rock removal at $4.75 per cubic yard.
Name of contractor: The United States Fidelity and Guaranty Co.
Date of contract: October 11, 1901.
Date of approval: November 9, 1901.
Date of commencement: On or before November 10, 1901.
Date of completion: October 31, 1902.
For construction and repair of dikes, material to be paid for at following rates: Piles, 9¾ cents per linear foot; sheet piling and square timber, $32 per 1,000 feet B. M.; round timber, 8½ cents per linear foot; iron, 3¾ cents per pound; rubble-stone and spalls, 80 cents per cubic yard; paving stone, $1.30 per cubic yard, and hire of dredging plant, $9 per hour.

COMMERCIAL STATISTICS.

The importance of the Hudson as a great waterway of commerce is apparent from the fact that, aside from its own local traffic, which in itself is very large, it absorbs all the traffic of the Erie, Champlain, and Delaware and Hudson canals, besides the great coal trade of the Pennsylvania Coal Company at Newburgh, and the Erie coal trade at Piermont.

The two principal industries on the river are ice and brick. There is said to be 87 ice houses between Albany and Hudson.

Amount of local commerce within limits of improvement, 1901.

	Tons.
General merchandise	776,908
Grain, flour, feed, etc	42,963
Lumber and timber	414,616
Fuel	671,882
Building materials	401,218
Ice	815,827
Total	3,123,400

Number of passengers carried in 1901, 1,293,286.

F 2.

IMPROVEMENT OF HARBOR AT SAUGERTIES, NEW YORK.

Operations for the year consisted in repairing the dikes at the entrance to the harbor under an emergency contract entered into with William Parrott, of Newburgh, N. Y.

The following material was used in repairing 2,009 linear feet of the South dike: 16,312 feet B. M. square timber; 1,996 linear feet round timber; 13,084 pounds tie rods, bolts, etc.; 316 cubic yards rubblestone.

On the North dike 205 cubic yards of rubblestone was used for refilling 100 linear feet and revetting 150 linear feet.

This work placed the dikes in fairly good condition.

Work under the project authorized by act of June 13, 1902, had not been commenced at the close of the year.

The available balance will be expended for rock removal, dike construction, and dredging under this project, and the appropriation recommended for fiscal year ending June 30, 1904, will be applied to necessary dike construction and dredging required to complete the project.

Money statement.

July 1, 1901, balance unexpended	$2,150.00
Amount appropriated by river and harbor act approved June 13, 1902	20,000.00
	22,150.00
June 30, 1902, amount expended during fiscal year	2,150.00
July 1, 1902, balance unexpended	20,000.00
Amount (estimated) required for completion of existing project	24,685.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	24,685.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

By act of—		
July 5, 1884	$5,000	
August 5, 1886	15,000	
August 11, 1888	12,000	
September 19, 1890	10,000	
July 13, 1892	5,000	
August 18, 1894	5,000	
June 3, 1896	2,500	
March 3, 1899	2,500	
		$57,000
June 13, 1902		20,000
Total		77,000

EMERGENCY CONTRACT IN FORCE DURING YEAR.

Name of contractor: William Parrott.
Date of contract: August 13, 1901.
Date of commencement: August 24, 1901.
Date of completion: November 1, 1901.
For repairing dikes, material furnished at following rates: Square timber, $37 per M feet B. M.; round timber, 9 cents per linear foot; iron, 3½ cents per pound; rubblestone, 85 cents per cubic yard.

COMMERCIAL STATISTICS.

Freight handled, 1901.

	Tons.
Bluestone	40,000
Coal	6,000
Building material	6,600
General merchandise	14,873
Total	67,473

This freight is carried in steam and sail vessels, and canal boats drawing from 7 to 11 feet of water.

Number of passengers carried, 15,000.

F 3.

IMPROVEMENT OF HARBOR AT RONDOUT, NEW YORK.

The project for the improvement of this harbor, providing for a permanent 14-foot channel 100 feet wide, was completed in 1880, at a cost of $90,000. Since then expenditures have been applied to maintenance.

No work was done during the fiscal year.

The available balance will be expended for maintenance, and the appropriation recommended for fiscal year ending June 30, 1904, will be applied to redredging the channel or repairing the dikes, as may be deemed most necessary.

Money statement.

Amount appropriated by river and harbor act approved June 13, 1902	$2,500.00
July 1, 1902, balance unexpended	2,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902, for maintenance of improvement	2,500.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act of—		By act of—	
June 12, 1872	$10,000	August 11, 1888	$5,000
March 3, 1873	20,000	September 19, 1890	5,000
June 8, 1875, allotment	1,000	July 13, 1892	5,000
August 14, 1876	30,000	August 18, 1894	5,000
June 15, 1878	30,000	June 3, 1896	2,500
August 2, 1882	2,000	June 13, 1902, allotment	2,500
July 5, 1884	1,000		
August 5, 1886	2,500	Total	121,500

COMMERCIAL STATISTICS.

Articles.	1901.
	Tons.
General merchandise	300,000
Coal	200,000
Brick and building material	525,000
Cement, lime, and sand	400,000
Ice	60,000
Total	1,485,000

This freight was carried in steam and sail vessels and canal boats drawing from 6 to 12 feet of water.

F 4.

IMPROVEMENT OF HARBOR AT PEEKSKILL, NEW YORK.

The project for the improvement of this locality, which provided for making a channel 100 feet wide and 10 feet deep from deep water in the Hudson River on the north, along the inner side of the harbor, to deep water on the south, was completed in 1899, at a cost of $19,400, which is less than two-fifths of the original estimate.

No work was done during the fiscal year.

The available balance will be expended for maintenance, and the appropriation recommended for fiscal year ending June 30, 1904, is to be used in widening and deepening the existing channel.

Money statement.

July 1, 1901, balance unexpended		$600.00
Amount appropriated by river and harbor act approved June 13, 1902		3,000.00
July 1, 1902, balance unexpended		3,600.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902:		
For works of improvement	$30,000.00	
For maintenance of improvement	3,000.00	
		33,000.00
Submitted in compliance with requirements of sundry civil act of July 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

By act of—	
June 3, 1896	$10,000
March 3, 1899	10,000
June 13, 1902 (allotment)	3,000
Total	23,000

COMMERCIAL STATISTICS.

No statistics were received for the year 1901, although timely application was made for them.

F 5.

IMPROVEMENT OF WAPPINGER CREEK, NEW YORK.

The project for improvement of this creek, which contemplated dredging a channel 80 feet wide and 8 feet deep from the mouth to the falls, was completed in 1892, at a cost of $13,000.

No work was done during the fiscal year.

The available funds will be applied to restoring the channel, as far as possible, to its former dimensions, and the appropriation recommended for the fiscal year ending June 30, 1904, will also be applied to maintenance.

Money statement.

Amount appropriated by river and harbor act approved June 13, 1902	$1,500.00
July 1, 1902, balance unexpended	1,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902, for maintenance of improvement	1,500.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

By act of—	
September 19, 1890	$13,000
June 13, 1902	1,500
Total	14,500

COMMERCIAL STATISTICS.

None have been compiled since 1888, during which year the tonnage amounted to 70,000 tons.

F 6.

IMPROVEMENT OF EAST RIVER AND HELL GATE, NEW YORK.

Work was continued at Man-o'-War rock under a contract entered into with the R. G. Packard Company. At the close of the fiscal year the removal of the rock to the 26-foot plane had practically been completed, only a small amount of cleaning up remaining to be done. The quantity of rock taken out during the year was 11,710 cubic yards, making the total amount removed to date 20,191 cubic yards.

The removal of the reef off Twenty-sixth street to the 26-foot plane had also practically been completed under a contract entered into with George A. Rogers, some cleaning up only remaining to be done. Total quantity of material removed during the fiscal year, 462 cubic yards.

Work was in progress under the same contract on the reef at Third street, which had been about half drilled and blasted. It is expected that the reef will be entirely removed by the end of July.

The plant laid up at Mill rock was cared for.

The work remaining to be done in order to complete the project is as follows:

Localities.	Least present depth.	Proposed depth.
	Feet.	*Feet.*
Battery reef	19	26
Reef off South Ferry slips	19	26
Shell reef, off Ninth street	15	18
Pilgrim rock, off Nineteenth street	24	26
Ferry reef, off Thirty-fourth street	24	26
Middle reef or Flood rock	18.3	26
Heel Tap	20.5	26
Frying Pan	18	26
Pot rock	22.3	26

With the available funds it is proposed to complete the removal of Pot rock and Shell reef and take out as much of the broken rock from Middle reef as possible. The appropriation recommended for fiscal year ending June 30, 1904, will be expended in completing work at the localities included in the project, doing first that which is most urgently needed. Unless the amount appropriated is made larger it will be many years before the improvement can be completed.

Money statement.

July 1, 1901, balance unexpended	$142,472.99
Amount appropriated by river and harbor act approved June 13, 1902	100,000.00
	242,472.99
June 30, 1902, amount expended during fiscal year	104,219.84
July 1, 1902, balance unexpended	138,253.15
July 1, 1902, outstanding liabilities	30,667.46
July 1, 1902, balance available	107,585.69
July 1, 1902, amount covered by uncompleted contracts	6,595.87
Amount (estimated) required for completion of existing project	903,840.67
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	400,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

By other than river and harbor acts prior to 1852	$18,861.59	
Act of—		
August 30, 1852	20,000.00	
		$33,861.59
July 25, 1868, allotment	85,000.00	
April 10, 1869, allotment [a]	176,841.45	
July 11, 1870	250,000.00	
March 3, 1871	250,000.00	
June 10, 1872	225,000.00	
March 3, 1873	225,000.00	
June 23, 1874 [b]	214,000.00	
March 3, 1875	250,000.00	
August 14, 1876	250,000.00	
June 18, 1878	350,000.00	
March 3, 1879	250,000.00	
June 14, 1880	200,000.00	
March 3, 1881	200,000.00	
May 4, 1882	50,000.00	
August 2, 1882	200,000.00	
July 5, 1884	360,000.00	
August 5, 1886	112,500.00	
August 11, 1888	250,000.00	
September 19, 1890	200,000.00	
July 13, 1892	150,000.00	
August 18, 1894	75,000.00	
June 3, 1896	60,000.00	
March 3, 1899	250,000.00	
June 13, 1902	100,000.00	
		4,733,341.45
Total		4,767,203.04

[a] Less $1,358.55 reverted to Treasury.
[b] Less $11,000 allotted to Harlem River improvement.

CONTRACTS IN FORCE DURING YEAR.

Name of contractor: R. G. Packard Company.
Date of contract: June 21, 1899.
Date of approval: July 13, 1899.
Date of commencement: On or before September 11, 1899.
Date of completion: Time limit waived.
Excavation and removal of Man-o'-War rock to a depth of 26 feet below mean low water for the lump sum of $159,000.
Name of contractor: George A. Rogers.
Date of contract: September 3, 1900.
Date of approval: September 12, 1900.
Date of commencement: On or before November 14, 1900.
Date of completion: Time limit waived.
Excavation and removal of reef off Twenty-sixth street and reef off Third street, aggregating 1,001 cubic yards, at $12.87 per cubic yard.

COMMERCIAL STATISTICS.

The commerce of East River is so intimately connected with that belonging to New York Harbor proper that it is impracticable to make a separate statement of it.

F 7.

IMPROVEMENT OF HARLEM RIVER, NEW YORK.

No work was done during the fiscal year, except to care for plant laid up at Mill Rock.

The available funds will be expended in widening and deepening the channel between the Hudson River and Macombs Dam Bridge, and in redredging the channel in the vicinity of the Second, Third and Fourth Avenue bridges, and the appropriation recommended for fiscal year ending June 30, 1904, will be applied to increasing the dimensions of the channel throughout its entire length from East to Hudson Rivers.

Unless the amount appropriated is made larger, it will be many years before the improvement can be completed.

Money statement.

July 1, 1901, balance unexpended	$3,339.64
Amount appropriated by river and harbor act approved June 13, 1902	75,000.00
	78,339.64
June 30, 1902, amount expended during fiscal year	2,042.42
July 1, 1902, balance unexpended	76,297.22
Amount (estimated) required for completion of existing project	1,380,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	500,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

By act of—		
June 23, 1874, allotment	$11,000	
March 13, 1875	10,000	
		$21,000
June 18, 1878	300,000	
March 3, 1879	100,000	
August 11, 1888	70,000	
September 19, 1890	250,000	
July 13, 1892	175,000	
August 18, 1894	125,000	
June 3, 1896	125,000	
March 3, 1899	100,000	
June 13, 1902	75,000	
		1,320,000
Total		1,341,000

COMMERCIAL STATISTICS.

The commerce of the Harlem River is so intimately connected with that belonging to East River and New York Harbor that a separate statement of it can not be made.

F 8.

IMPROVEMENT OF NEWTOWN CREEK, NEW YORK.

No work was done during the fiscal year.

The available funds will be applied to maintenance of the dredged channel.

Money statement.

July 1, 1901, balance unexpended	$15,685.61
June 30, 1902, amount expended during fiscal year	400.00
July 1, 1902, balance unexpended	15,285.61
July 1, 1902, outstanding liabilities	335.00
July 1, 1902, balance available	14,950.61

APPROPRIATIONS.

By act of—		
June 14, 1880	$10,000	
August 2, 1882	15,000	
July 5, 1884	20,000	
August 5, 1886	37,500	
August 11, 1888	25,000	
September 19, 1890	35,000	
July 13, 1892	35,000	
August 18, 1894	20,000	
		$197,500
June 3, 1896	30,000	
June 4, 1897	183,000	
		213,000
Total		410,509

COMMERCIAL STATISTICS.

It was not practicable to obtain reliable statistics for the calendar year 1901.

F 9.

ESTABLISHMENT OF HARBOR LINES IN HUDSON RIVER AT ADAMS ISLAND, TROY, NEW YORK.

UNITED STATES ENGINEER OFFICE,
New York City, January 28, 1902.

GENERAL: I have the honor to forward herewith a letter from Messrs. Kirk, Driscoll & Co. to the Secretary of War, sent through this office, requesting the establishment of bulkhead lines around Adams Island, on the west side of the channel in the Hudson River, between the Delaware and Hudson Company's bridge and the State Dam, at Troy. The proposed lines are shown on the accompanying tracing.[a]

It is respectfully recommended that the lines * * * be established by the Secretary of War.

* * * * * * *

Very respectfully, your obedient servant,

S. M. MANSFIELD,
Colonel, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. Army.

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
February 19, 1902.

Respectfully submitted to the Secretary of War.

Kirk, Driscoll & Co., contractors at work on the improvement of the Hudson River, request the establishment of harbor lines around Adams Island, at Troy, N. Y., which they have leased as a dumping ground. The matter has received consideration at the hands of the local engineer officer, Colonel Mansfield, and I recommend that the lines selected be approved.

These lines are indicated on the accompanying chart, and accurately described in a separate paper herewith; and it is further recommended that the Secretary place his approval on both the chart and the description.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

DESCRIPTION OF PROPOSED HARBOR LINE FOR ADAMS ISLAND, HUDSON RIVER, OPPOSITE TROY, NEW YORK.

Beginning at a point in the Hudson River, New York, 15 feet west of the westerly channel line, approved in 1899, which point is in the westerly prolongation of the northerly building line of Jay street, and 398 feet, more or less, distant from

[a] Not printed.

the westerly building line of River street, Troy; thence northerly in a straight line 1,188 feet, parallel to and 15 feet distant from aforesaid channel line; thence in a straight line 621.82 feet southwesterly to a point which is 303 feet west of the bulkhead line just described, measured on a line erected perpendicular thereto, from a point 645 feet north of the point of beginning; thence southerly in a straight line 1,873.66 feet to a point 15 feet west of the aforesaid channel line and 1,204 feet south of point of beginning; thence northerly in a straight line 1,204 feet parallel to and 15 feet distant from aforesaid channel line to the point and place of beginning.

WAR DEPARTMENT,
February 24, 1902.

Approved.
WM. CARY SANGER,
Assistant Secretary of War.

F 10.

MODIFICATION OF HARBOR LINES ALONG HUDSON RIVER AT NEW BALTIMORE, NEW YORK.

SIR: We, the undersigned, residents of the town of New Baltimore, Greene County, N. Y., and owners and lessees of lands fronting on and under the waters of the Hudson River, hereby respectfully petition, that the existing bulkhead line of said Hudson River in the southerly part of said town of New Baltimore, be changed, so as to run in a straight line from the northeast corner of Vanderpool's dock at Matthew Point to the angle in the dike south of Bronk & Gay's ice house; and that the west bulkhead line of the Hudson River between the aforesaid points be thus established and hereafter maintained.

This change in the Hudson River's west bulkhead line requested will in no wise encroach upon the channel nor constitute an impediment to navigation, and it is desired and proposed solely for the purpose of overcoming the disadvantages and inconveniences of the present bulkhead line, at the points mentioned, which result from the present line being too close to the high rocky shore to allow for the maintaining and operating of the industries located at and between the above-mentioned points. The interests of navigation will be better served also by making the above change.

JAMES H. BRONK,
A. MATHEWS,
Owners.
CHAS. VAN HOESEN,
WILLIAM I. FULLER,
A. J. VANDERPOOL,
Lessees.

To the SECRETARY OF WAR.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
July 29, 1901.

Respectfully referred to Col. S. M. Mansfield, Corps on Engineers, for report.

To be returned.

A. MACKENZIE,
Acting Chief of Engineers.

[Third indorsement.]

U. S. ENGINEER OFFICE, ARMY BUILDING,
New York, August 6, 1901.

Respectfully returned to the Chief of Engineers, U. S. Army, with report of this date.

S. M. MANSFIELD,
Colonel, Corps of Engineers.

REPORT OF COL. S. M. MANSFIELD, CORPS OF ENGINEERS.

ENGINEER OFFICE, U. S. ARMY,
New York, N. Y., August 6, 1901.

GENERAL: In compliance with instructions contained in Department indorsement of July 29, 1901, on request of James H. Bronk, A. Mathews, and others, that the existing bulkhead line on the Hudson River at New Baltimore be changed, I have the honor to submit the following report and recommend that the proposed change be authorized, as shown on accompanying tracing.[a]

The following is a description of the proposed new line:

Beginning at a point in the pier-head and bulkhead line of the west shore of the Hudson River at Mathews Point, approved by the Secretary of War March 25, 1890, the coordinates of which referred to a base line through State survey station "Vanderpoel 181" as origin and State survey station "Stone House 245"; the abscissa is 3,913 feet and the ordinate 885 feet; thence southerly in a straight line for a distance of about 3,200 feet until it is tangent to the Bronks Island dike.

Very respectfully, your obedient servant,

S. M. MANSFIELD,
Colonel, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. Army.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
August 9, 1901.

Respectfully submitted to the Secretary of War.

Colonel Mansfield reports favorably upon the accompanying request of certain riparian owners and lessees at New Baltimore, N. Y., for modification of the existing bulkhead line in Hudson River at said place, and recommends that the modification described within and delineated upon the accompanying tracing be adopted.

Concurring in his views, I recommend that the proposed modification be approved and that the Secretary place his approval both upon the tracing, which has been prepared for his signature, and upon this paper.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

[a] Not printed.

[Second indorsement.]

WAR DEPARTMENT, *August 12, 1901.*

Approved.

WM. CARY SANGER,
Acting Secretary of War.

F 11.

MODIFICATION OF HARBOR LINES ALONG EAST RIVER AT STEINWAY, NEW YORK CITY, NEW YORK.

ASTORIA VENEER MILLS,
Long Island City, N. Y., January 11, 1902.

SIR: I have the honor to request information on the following: According to the map of pier and bulkhead lines adopted and approved January 6 (9), 1891, that portion of the riparian right grant to Steinway & Sons, as indicated by dotted ink line, has taken away the pierhead right. This is a severe loss, as it takes away the value of pierhead. This I believe your Department will correct, if investigated, as the line established is away back from the channel, when the water is but 3 feet deep at low water.

I should like to know what procedure is necessary to have this correction made, as we are interested in the property and want to build.

Respectfully, yours,

ALEX. S. WILLIAMS.

WAR DEPARTMENT, *Washington, D. C.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
January 18, 1902.

Respectfully referred to Col. Chas. R. Suter, Corps of Engineers, for consideration and report by the New York Harbor Line Board.

To be returned.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Third indorsement.]

NEW YORK HARBOR LINE BOARD,
ARMY BUILDING,
New York City, January 27, 1902.

Respectfully returned to the Chief of Engineers, inviting attention to the report of the board of this date.

CHAS. R. SUTER,
Colonel, Corps Engineers,
President Harbor Line Board.

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
February 7, 1902.

Respectfully returned to the Secretary of War.

Objection having been raised to the existing harbor lines at Steinway, East River, New York City, the matter has been referred for consideration by the New York Harbor Line Board.

Inviting attention to the accompanying report of the board, dated January 27, 1902, it is recommended that the modified lines selected, which are described at length in the report and delineated on a chart[a] herewith, be approved. It is further recommended that the Secretary place his approval upon the accompanying report and chart, both of which have been prepared for his signature.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

REPORT OF THE NEW YORK HARBOR LINE BOARD.

HARBOR LINE BOARD,
New York City, January 27, 1902.

GENERAL: The New York Harbor Line Board has the honor to submit the following report on the application of the Astoria Veneer Mills for modification of the pier and bulk head lines at Steinway, East River, New York City, which was referred to the board for consideration and report by your indorsement of January 18, 1902.

After a careful consideration of this matter the board recommends that the pier and bulk head lines in the vicinity in question be approved as indicated on the map herewith forwarded. This modification, if approved, will fully cover the request of the applicants.

The modified lines herein recommended are described as follows:

DESCRIPTION OF THE BULKHEAD LINE FOR THE EASTERLY SIDE OF STEINWAY CREEK AND THE SOUTHERLY SHORE OF BOWERY BAY.

The bulkhead line begins at a point in the bulkhead line approved by the Secretary of War January 9, 1891, in the northerly side of Riker avenue 257 feet west of the westerly side of Blackwell street; thence northerly in a straight line to a point in a line 343 feet (perpendicular distance) from the westerly side of Blackwell street and 102 feet north of the northerly side of Riker avenue; thence on the arc of a circle of 380 feet radius to a point in a line 419 feet (perpendicular distance) west of the westerly side of Blackwell street and 252 feet north of the northerly side of Riker avenue; thence on the arc of a circle of 650 feet radius to a point in a line 423 feet (perpendicular distance) west of the westerly side of Blackwell street and 558 feet north of the northerly side of Riker avenue; thence easterly on the arc of a circle of 700 feet radius to a point in a line 1,100 feet (perpendicular distance) north of the northerly side of Riker avenue and 10 feet west of the westerly side of Pomeroy street, prolonged northerly; thence southeasterly in a straight line along the northerly side of Berrian avenue, and 1,100 feet from the northerly side of and parallel to Riker avenue until it intersects the bulkhead line approved by the Secretary of War January 9, 1891.

The pierhead line is described as follows:

The pierhead line is coincident with the bulkhead line on the easterly shore of Steinway Creek, above described, until it intersects the easterly side of Blackwell street 1,079 feet north of the northerly side of Riker avenue; thence the pierhead line departs from the bulkhead line and continues northeasterly in a straight line to a point in the westerly side of Pomeroy street, prolonged northerly, 2,100 feet north of the northerly side of Riker avenue; thence southeasterly in a straight

[a] Not printed.

line 1,000 feet from and parallel to the bulkhead line until it intersects the pierhead line approved by the Secretary of War January 9, 1891.

Respectfully submitted.

CHAS. R. SUTER,
Colonel, Corps of Engineers.
S. M. MANSFIELD,
Colonel, Corps of Engineers.
W. L. MARSHALL,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. Army.

[First indorsement.]

WAR DEPARTMENT,
February 8, 1902.

Approved.

WM. CARY SANGER,
Assistant Secretary of War.

F 12.

MODIFICATION OF HARBOR LINES ALONG EAST RIVER IN FRONT OF THE COB DOCK, UNITED STATES NAVY-YARD, BROOKLYN, NEW YORK.

NAVY DEPARTMENT,
Washington, November 19, 1901.

SIR: I have the honor to inclose herewith, for your information and consideration, a copy of a letter, dated the 18th instant, from the chief of the Bureau of Yards and Docks of this Department relative to a change in the position of the pier-head line on the East River side of the cob dock, navy-yard, New York, in order to accommodate the longest vessels of the Navy, in connection with the construction of piers for berthing vessels at that place, and to request that, for the reasons set forth by the Bureau of Yards and Docks, a change in the position of the present pier-head line be authorized to conform to that proposed in the tracing[a] herewith inclosed, or to one as nearly thereto as in your opinion the interests of navigation will allow.

I have the honor to be, sir, very respectfully,

JOHN D. LONG, *Secretary.*

The honorable the SECRETARY OF WAR.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
November 22, 1901.

Respectfully referred to Col. Charles R. Suter, Corps of Engineers, for consideration and report by the New York Harbor Line Board.

To be returned.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
Colonel, Corps of Engineers.

[a] Not printed.

[Third indorsement.]

THE NEW YORK HARBOR LINE BOARD,
ARMY BUILDING,
New York City, November 30, 1901.

Respectfully returned to the Chief of Engineers, inviting attention to the report of the board of this date.

CHAS. R. SUTER,
Colonel, Corps of Engineers,
President of the Board.

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
December 9, 1901.

Respectfully returned to the Secretary of War.

The Secretary of the Navy requests a change in the established harbor line on the East River side of cob dock to permit the carrying out of certain proposed improvements at the United States Navy-Yard, borough of Brooklyn, N. Y.

Inviting attention to the report of the 30th ultimo in the matter by the New York Harbor Line Board, I recommend that the modifications in pier-head and bulkhead lines recommended by the board, as described in its report and indicated on the accompanying chart,[a] be approved by the Secretary of War, and that the Secretary note his approval on the report and tracing, both of which have been prepared for his signature.

The line recommended for approval is the one desired by the Navy Department.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

REPORT OF THE NEW YORK HARBOR LINE BOARD.

HARBOR LINE BOARD,
New York City, November 30, 1901.

GENERAL: The New York Harbor Line Board has given consideration to the application of the Secretary of the Navy for a modification of the existing harbor lines in the vicinity of the Cob Dock, United States Navy-Yard, borough of Brooklyn, N. Y., which was referred to it by your indorsement of November 22, 1901, and has the honor to recommend the following changes, which, if approved, will enable the Navy Department to carry out its wishes with regard to the construction of piers on the Cob Dock front.

It is proposed to modify the pierhead line in front of Cob Dock, and the pier and bulkhead lines for the east shore of Wallabout channel, extending from the navy-yard wall at the Clinton avenue extension to South Ninth street. This proposed modification is described as follows:

The modification in the pierhead and bulkhead line in front of Cob Dock, United States Navy-Yard, begins at the southwesterly corner of Cob Dock at the point of tangency of the southeasterly prolongation of the radius of an arc of a

[a] Not printed.

circle, drawn with a radius of 3,500 feet from a point on the bulkhead at the foot of Little street, 395 feet north of (perpendicular distance) the north side of Marshall street, prolonged easterly, and 489 feet from the east side of Hudson avenue, to a point in the pierhead line approved by the Secretary of War, February 8, 1890, in the south side of South Ninth street, prolonged westerly 624 feet from the westerly side of Kent avenue; thence northerly along said radius to the point of intersection with the arc of the aforesaid circle; thence northeasterly along said arc to the point of intersection with the southeasterly prolongation of the radius drawn tangent to the curve of the northeast corner of the bulkhead of Cob Dock; thence southeasterly along said radius prolonged southeasterly to the point of tangency of the curved bulkhead of the northeasterly end of Cob Dock.

The pierhead and bulkhead lines along the easterly side of Wallabout channel from Clinton avenue extension (boundary wall of United States Navy-Yard) along the bulkhead as built to the southerly side of South Ninth street.

The bulkhead line is described as follows:

Beginning at a point in the westerly side of Clinton avenue extension, 1,740 feet north of the northerly side of Flushing avenue; thence in a straight line to a point at the southwest corner of the bulkhead at the entrance to Kent avenue basin 188 feet southerly (perpendicular distance) of the north side of Cross street; prolonged westerly 560 feet from the westerly side of Kent avenue (formerly First avenue); thence in a straight line to a point in the north side of Cross street 500 feet west of the westerly side of Kent avenue; thence in a straight line to a point in the southwesterly prolongation of the northerly side of Rush street 450 feet from the westerly side of Kent avenue; thence in a straight line to a point 310 feet (perpendicular distance) west of the easterly side of Kent avenue and 100 feet south of the southerly side of Division avenue; thence in a straight line to a point 215 feet (perpendicular distance) west of the westerly side of Kent avenue and 230 feet south of the south side of South Eleventh street; thence in a straight line to a point in the north side of South Eleventh street prolonged westerly 358 feet from the west side of Kent avenue; thence in a straight line to a point in the bulkhead line approved by the Secretary of War, February 8, 1890, in the southerly side of South Ninth street prolonged westerly 366 feet from the west side of Kent avenue.

The pierhead line is described as follows:

The pierhead line is coincident with the bulkhead line to the point in the north side of South Eleventh street prolonged westerly 358 feet from the west side of Kent avenue; thence in a straight line to a point in the pierhead line approved by the Secretary of War, February 8, 1890, in the southerly side of South Ninth street prolonged westerly 624 feet from the west side of Kent avenue.

A tracing is forwarded this date, in a separate roll, upon which is delineated the modified lines herein recommended.

It is to be remarked that there are other parts of the Brooklyn Navy-Yard front where the board has refrained from recommending the establishment of harbor lines for the reason that the property affected belongs to the Navy Department, and the definite fixing of such lines may well await the future plans of that Department for the utilization of their frontage.

Respectfully submitted.

CHAS. R. SUTER,
Colonel, Corps of Engineers.
S. M. MANSFIELD,
Colonel, Corps of Engineers.
W. L. MARSHALL,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. Army.

[First indorsement.]

WAR DEPARTMENT,
December 19, 1901.

Approved.

WM. CAREY SANGER,
Assistant Secretary of War.

APPENDIX G.

IMPROVEMENT OF NEW YORK HARBOR, OF BAY RIDGE, RED HOOK AND BUTTERMILK CHANNELS, AND GOWANUS CREEK CHANNEL, NEW YORK—ENLARGEMENT OF GOVERNORS ISLAND, NEW YORK HARBOR.

REPORT OF MAJ. W. L. MARSHALL, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1902, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. New York Harbor, New York.
2. Bay Ridge and Red Hook channels, New York Harbor.
3. Buttermilk Channel, New York Harbor.
4. Gowanus Creek Channel, New York.
5. Governors Island, New York Harbor.
6. Removing sunken vessels or craft, obstructing or endangering navigation.

HARBOR LINES.

7. Buttermilk Channel, New York Harbor, at Atlantic Basin, Brooklyn, N. Y.
8. Around Shooters Island, New York Harbor, N. Y.
9. At Ellis Island, New York Harbor, New York.

UNITED STATES ENGINEER OFFICE,
New York City, July 18, 1902.

GENERAL: I have the honor to submit herewith annual report upon works of river and harbor improvement in my charge for the fiscal year ending June 30, 1902.

Very respectfully, your obedient servant,

W. L. MARSHALL,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

G 1.

IMPROVEMENT OF NEW YORK HARBOR, NEW YORK.

The title "Improvement of New York Harbor" has been applied to the improvement of the channels of the main entrance from the sea. A general description of the harbor, the different channels of the

main entrance, and of the projects for improvement, is printed in the Annual Report of the Chief of Engineers for 1901, pages 1285–7.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1902.

Maintenance.—At the beginning of the year the United States dredging steamer *Gedney* was working on shoals on the west side of Main Ship Channel, removing the soft mud which the ebbing tide deposits there. This work was continued until July 17, making depths of 30 feet at mean low water where the shoals had been from 25 to 30 feet, and widening the channel on the west side to a width of 500 feet from the center line as far north as 600 feet above buoy C 5. July 18 the *Gedney* was transferred to Bayside Channel and continued there until September 18, removing small shoals and straightening the edge of the channel on the northwest side near the Swash Channel range. September 20 the *Gedney* was laid up for the season, the balance of funds available being insufficient to prosecute the improvement to advantage. During the year the total amount of material excavated was 87,658 cubic yards, of which 10,456 yards were mud removed from Main Ship Channel and 77,202 yards were sand from Bayside Channel.

The working time and lost time during the year were as follows:

	Days.
Actually at work	45
Work prevented by weather (fog, storms, etc.)	13
Occupied in repairs	6
Lost, other causes	1
Sundays and holidays	14
	79
Laid up since September 18	286
Total	365

The actual rate of operating expenses per cubic yard of material dredged during the past fiscal year is estimated at 6.7 cents, of which 4.6 cents is chargeable to wages, 1.6 cents to fuel and water, and 0.5 cents to repairs and supplies.

The cost of operation has always been found to be about twice as great in mud as in sand, partly because the mud is farther up the harbor, requiring a larger trip to the dumping ground, and largely because the mud does not settle quickly in the hoppers, and a considerable proportion is carried off in the overflow. The repairs made during the past year were all small and the cost is below the average.

AMBROSE CHANNEL.

At the beginning of the year dredging was in progress under the continuing contract for the entire excavation of the channel, about 42,500,000 cubic yards, entered into May 12, 1899, approved by the Chief of Engineers May 24, 1899. The specifications required that excavations should begin within twelve months from the date of approval of the contract and should continue during eight working months of each year, at an average monthly rate of not less than 400,000 cubic yards for the first working year and not less than 1,200,000 cubic yards for each succeeding year. This would require the contractor to begin work by May 24, 1900, to remove 3,200,000 cubic yards by May 24, 1901, 4,640,000 by June 30, 1901, and 9,600,000

cubic yards during each year thereafter. On account of delays in building the plant, the contractor did not fairly begin work until June, 1901, and as the contract provided that payment should be withheld whenever he was deficient in the amount of excavation required, it was apparent that he would never be able to make up the lost time, and would consequently receive no payment until the completion of the contract. In order to make it possible for him to continue work, supplementary articles of agreement were entered into July 18, 1901, approved by the Acting Secretary of War August 5, 1901, providing that the date required for beginning work should be July 1, 1901, instead of May 24, 1900, and that all expenses for inspection prior to the new date of beginning should be charged against the contractor.

During the past fiscal year dredging has been continued with two large suction dredges, working on the outer side of the sand bar, at the outer end of Ambrose Channel; 5,015,568 cubic yards of material have been removed during the year, making a total, under the contract, of 5,438,777 cubic yards. The channel has been dredged to the full width, 2,000 feet, for a length of 2,500 feet, and along the south edge with width of about 600 feet for an additional length of 2,500 feet. The original depth on this bar was 16 feet at mean low water. The depths resulting from excavation are very irregular, shoals being left 30 feet deep or less, and some parts being made 15 and even 20 feet deeper than the required depth of 40 feet. The contract does not permit payment for material dredged below 40 feet depth, and frequent examinations are needed to ascertain the amounts to be deducted; they are ordinarily about 16 per cent of the total amounts excavated.

Necessary examinations of the outer part of Ambrose Channel and of the 30-foot channels have been made during the year.

PRESENT CONDITION OF IMPROVEMENT.

The improved channels to the sea by way of Sandy Hook have full depth of 30 feet at mean low water, with width of 1,000 feet or more, except at places where shoaling has occurred along channel banks, limiting the width to between 800 and 1,000 feet.

Ambrose Channel has an available depth of about 16 feet at mean low water, the dredging in progress not yet being extended through the crest of the bar.

PROPOSED OPERATIONS.

It is proposed to apply the funds available for maintenance to removing shoals in the improved channels in order to restore and maintain the projected depth, and to apply the funds for Ambrose Channel to extending the channel through the outer bar under a continuing contract now in force.

Under the terms of the existing contract for deepening Ambrose Channel the amount of excavation required up to June 30, 1904, is 22,400,000 cubic yards. It is believed, however, that by that date the contractor can not exceed a total of 18,000,000 cubic yards excavation, and that the payments to become due on this total, less retained percentages, but including all contingent expenses, will not exceed $1,620,000. The amounts already appropriated for this work aggregate $1,280,000, and for the reasons above given it is estimated that

the additional amount required for the fiscal year ending June 30, 1904, is $340,000.

Money statement.

GENERAL IMPROVEMENT.

July 1, 1901, balance unexpended	$15,828.90
Amount appropriated by river and harbor act approved June 13, 1902	50,000.00
	65,828.90
June 30, 1902, amount expended during fiscal year	13,715.54
July 1, 1902, balance unexpended	52,113.36
July 1, 1902, outstanding liabilities	181.93
July 1, 1902, balance available	51,931.43
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902, for maintenance of improvement. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	100,000.00

AMBROSE CHANNEL.

July 1, 1901, balance unexpended		1,095,830.79
Amount appropriated by sundry civil act approved June 28, 1902		150,000.00
		1,245,830.79
June 30, 1902, amount expended during fiscal year	$368,767.17	
June 30, 1902, amount withdrawn, expenses office, C. of E.	500.00	
		369,267.17
July 1, 1902, balance unexpended		876,563.62
July 1, 1902, outstanding liabilities		45,408.42
July 1, 1902, balance available		831,155.20
July 1, 1902, amount covered by uncompleted contracts		2,420,034.28
Amount (estimated) required for completion of existing project		2,720,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902		340,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

Appropriations for improving New York Harbor have been made, as follows:

Application.	Date.	Amount.
For Gedney Channel, dredging via Sandy Hook	July 5, 1884	$200,000.00
For New York Harbor	Aug. 5, 1886	750,000.00
Do	Aug. 11, 1888	380,000.00
Do	Sept. 19, 1890	160,000.00
Do	July 13, 1892	170,000.00
Do	Aug. 18, 1894	75,000.00
Do	June 3, 1896	60,000.00
Do	Mar. 3, 1899	100,000.00
Do	June 13, 1902	50,000.00
		1,945,000.00
Received from other sources		28,024.52
Total		1,973,024.52
For East (Ambrose) Channel, dredging	Mar. 3, 1899	1,000,000.00
Do	Mar. 3, 1901	130,000.00
Do	June 28, 1902	150,000.00
Total		1,280,000.00

CONTRACT IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1902.

With Andrew Onderdonk, of New York, N. Y., for excavating in East (Ambrose) Channel, New York Harbor, and removing about 42,500,000 cubic yards of material, at a rate of 9 cents per cubic yard; date of contract, May 12, 1899; approved by the Chief of Engineers May 24, 1899, and supplemental articles of agreement, dated July 18, 1901, providing for beginning work July 1, 1901, instead of May 24, 1900; date of expiration indefinite, depending on appropriations by Congress. Work in progress.

COMMERCIAL STATISTICS.

The following statement concerning foreign commerce of the port of New York is compiled from the annual report of the Chamber of Commerce of the State of New York for the year 1901–2. It comprises only imports from and exports to foreign countries and does not include the domestic, coastwise, and local traffic. Vessels trading with domestic ports are not required to take out clearance papers, and no statistics of their carrying trade are accessible.

The leading articles of imports into the United States at the port of New York for the year ending June 30, 1901, were sugar, molasses, coffee and tea, wool, cloths and dress goods, leather and leather goods, tin, rubber, and tobacco, with other miscellaneous imports, aggregating about 3,629,600 tons, valued at $554,691,683.

The value of such imports for all other ports of the United States for the same period was $370,918,190.

The leading articles of export were cotton, breadstuffs and other provisions, oils, tobacco, metals, and manufactures, which, with miscellaneous items, aggregated about 6,802,494 tons, valued at $633,535,949.

The value of such exports for all other ports of the United States for the same year was $971,699,399.

Statement of the number and tonnage of all vessels belonging to the port of New York, June 30, 1901.

	Number.	Tonnage.
Sailing vessels	1,481	300,136
Steam vessels	1,266	611,775
Canal boats	238	30,238
Barges	1,033	243,218
Total	4,018	1,185,367

From the records of the New York and New Jersey pilot commissioners the following data concerning deep-draft vessels crossing Sandy Hook bar have been compiled for the calendar year 1900:

Draft.	Leaving.		Arriving.	
	Number of vessels.	Number of trips.	Number of vessels.	Number of trips.
32 feet or over	4	13		
31 feet and under 32 feet	12	21		
30 feet and under 31 feet	21	56		
29 feet and under 30 feet	31	78	1	2
28 feet and under 29 feet	61	182	4	12
27 feet and under 28 feet	80	216	8	38
Total		561		52

Maximum draft of vessels leaving the harbor, 32 feet 6 inches. Maximum draft of vessels entering the harbor, 29 feet.

Total number of different vessels of 27 feet draft or over, 109.

Before the improvement of Gedney Channel vessels drawing 27 feet could only cross the bar at extreme high tide.

G 2.

IMPROVEMENT OF BAY RIDGE AND RED HOOK CHANNELS, NEW YORK HARBOR.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1902.

At the beginning of the year dredging was in progress on Bay Ridge Channel under continuing contract; it was continued throughout the year, except for suspension during the month of February, and 2,238,023 cubic yards of sand and mud were removed, making the total excavation June 30, 1902, 2,522,524 cubic yards. The work done has been on the easterly side of the projected Bay Ridge Channel, and so far has resulted in making a channel of 35 feet depth or over, with width of 500 feet, for the full length of the channel.

The contractors have employed in this work three dredges, a clamshell dredge, a suction dredge, and a dipper dredge, the last two being built for this work; they have also employed two hired dredges for short periods, but they did not prove efficient.

The contract for this work provided that excavation should be begun within nine months from the date of approval of the contract and should be prosecuted thereafter at a rate of about 300,000 cubic yards per month for ten working months of each year, but that payments should be due only when the total amount of excavation was as great as was required by this rate, and that no payments should be made for any excavation below 40 feet depth. The contract was approved August 14, 1899, and work should have been begun May 14, 1900. The contractors met with many delays in building their plant and were unable to begin work until March 18, 1901, and their full plant was not equipped until November, 1901, which left them so far behind the amounts required that it was apparent they could not make up the deficiency so as to secure payment until the contract should be completed. There was no other plant known to be available and at all adapted to excavating this channel to a depth of 40 feet, and therefore, in order to make it possible for the contractors to keep their plant in operation, and thus secure the earliest practicable completion of the projected channels, supplementary articles of agreement were entered into under date of May 7, 1902, approved by the Chief of Engineers May 12, 1902, which provided that the date for beginning work should be changed from May 14, 1900, to November 1, 1901.

When, under this supplemental agreement, payment became due, a detailed examination of the bottom was made, which showed that 22¾ per cent of the material excavated was below 40 feet depth and was not to be paid for. The plant is capable of much better work than this, and it is probable that future examinations will show a less proportionate deduction, and perhaps a less actual deduction, due to filling in along the east bank.

PRESENT CONDITION OF IMPROVEMENT.

Bay Ridge Channel has a navigable depth of at least 35 feet at mean low water, with 500 feet width, from deep water at the lower end to the upper end, at the Erie Basin bulkhead. Red Hook Channel, dredged 26 feet deep and 400 feet wide in 1899, has shoaled along the sides, and retains the full depth for about 300 feet width; work on this channel, under the existing contract for 40 feet depth is not yet begun.

PROPOSED OPERATIONS.

With the available funds and future operations, it is proposed to continue dredging Bay Ridge and Red Hook channels under the authorized continuing contract.

The estimated amount which will be required under the contract for the fiscal year ending June 30, 1904, is $348,000. It is estimated that the total amount excavated by that date may be about 9,500,000 cubic yards, which, at 10 cents per yard, would amount to $950,000; the amount already appropriated is $602,000, and the difference is believed to be sufficient to pay all obligations which will be incurred up to June 30, 1904, including contingent expenses, but not including percentages to be retained until completion of contract.

These channels are in the collection district of New York, of which New York City is the port of entry. The nearest light-house is the Statue of Liberty Enlightening the World, on Bedloes Island, about 1½ miles west. The nearest work of defense is Fort Columbus, Governors Island, New York.

Money statement.

July 1, 1901, balance unexpended		$488,815.10
Amount appropriated by sundry civil act approved June 28, 1902		100,000.00
		588,815.10
June 30, 1902, amount expended during fiscal year	$172,038.62	
June 30, 1902, amount withdrawn, expenses office, C. of E.	500.00	
		172,538.62
July 1, 1902, balance unexpended		416,276.48
July 1, 1902, outstanding liabilities		61,723.78
July 1, 1902, balance available		354,552.70
July 1, 1902, amount covered by uncompleted contracts		1,947,747.60
Amount (estimated) required for completion of existing project		1,898,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902		348,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

Appropriations for improving Bay Ridge and Red Hook channels, New York Harbor, have been made as follows:

For previous projects.

Application.	Date.	Amount.
Dredging	Mar. 4, 1881	$40,000
Do	Aug. 2, 1882	20,000
Do	July 5, 1884	5,000
Do	Aug. 5, 1886	7,500
Do	Aug. 11, 1888	60,000
Do	Sept. 19, 1890	100,000
Do	July 13, 1892	198,600
Do	Aug. 18, 1894	150,000
Do	June 3, 1896	
Do	June 4, 1897	[a]530,000
Do	July 1, 1898	
Total		[b]1,171,100

[a] These three appropriations, aggregating $680,000, were applied under continuing contract to dredging Bay Ridge, Red Hook, and Buttermilk channels; it is estimated that about $530,000 were applied to Bay Ridge and Red Hook channels.

[b] This total includes small sums applied to dredging in Gowanus Canal, the amounts of which are not definitely known.

For present project of 1899.

Application.	Date.	Amount.
Dredging	Mar. 3, 1899	$100,000
Do	June 6, 1900	202,000
Do	Mar. 3, 1901	140,000
Do	June 28, 1902	100,000
Total		602,000

CONTRACT IN FORCE.

For excavating Bay Ridge and Red Hook channels, 1,200 feet wide and 40 feet deep at mean low water, removing 22,000,000 cubic yards, more or less, at 10 cents per cubic yard, measured in scows.

Name of contractor, Hughes Bros. & Bangs, of Syracuse, N. Y.; date of contract, July 31, 1899, and supplemental contract dated May 7, 1902, providing for begining work November 1, 1901, instead of May 14, 1900; expiration of contract, indefinite, depending upon appropriations by Congress. Work in progress.

COMMERCIAL STATISTICS.

Statistics for the calendar year 1901 have not been collected in detail.

One new line of transportation—the New York and Hawaiian Steamship Line—has been established, with its terminal at Forty-second street, Brooklyn, during the year 1901.

G 3.

IMPROVEMENT OF BUTTERMILK CHANNEL, NEW YORK HARBOR.

The improvement of this channel was begun in 1880; in 1896 it was consolidated with the improvement of Bay Ridge and Red Hook channels, under a project completed in 1899. Since that time it has been considered separately.

OPERATION DURING THE FISCAL YEAR ENDING JUNE 30, 1902.

At the beginning of the year no project for improvement was in progress and no funds for work were available.

The river and harbor act approved June 13, 1902, appropriated $90,000 for "Improving Buttermilk Channel, New York Harbor, New York, in accordance with House document numbered one hundred and twenty-two, Fifty-sixth Congress, second session, with a view to obtaining a channel not less than thirty feet deep." A project for expenditure of this appropriation has been submitted.

PRESENT CONDITION OF IMPROVEMENT.

Buttermilk Channel has been made 26 feet deep at mean low water by removing the shoals (of less than that depth) to a width of 1,000 feet. It retains that depth generally, except on the west side near the upper end, where an eddy of slack water at the convergence of the Buttermilk Channel and East River tides causes a deposit of soft sand.

PROPOSED OPERATIONS.

It is proposed to apply the available funds to dredging in accordance with the terms of the river and harbor act of 1902. It is estimated that they will suffice to make the channel 30 feet deep at mean low water with width of about 400 feet.

Money statement.

Amount appropriated by river and harbor act approved June 13, 1902	$90,000.00
July 1, 1902, balance unexpended	90,000.00

Appropriations for improving Buttermilk Channel, New York Harbor, have been made as follows:

For previous projects.

Application.	Date.	Amount.
Dredging	June 14, 1880	$60,000
Do	Mar. 4, 1881	60,000
Do	Aug. 2, 1882	60,000
Do	July 5, 1884	10,000
Do	Aug. 5, 1886	56,250
Do	Aug. 11, 1888	100,000
Do	July 13, 1892	100,000
Do	Aug. 18, 1894	50,000
Do	June 3, 1896	
Do	June 4, 1897	[a] 150,000
Do	July 1, 1898	
Received from other sources		100
Total		646,350

[a] Part of three appropriations for improving Bay Ridge, Red Hook, and Buttermilk channels, aggregating $680,000, of which it is estimated that about $150,000 was applied to Buttermilk channel.

For project of 1902.

Application.	Date.	Amount.
Not yet expended	June 13, 1902	$90,000

There is no contract in force for improving Buttermilk Channel.

COMMERCIAL STATISTICS.

Statistics for the calendar year of 1901 have not been collected in detail.

G 4.

IMPROVEMENT OF GOWANUS CREEK CHANNEL, NEW YORK.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1902.

At the beginning of the year no funds were available for continuing the improvement.

The river and harbor act, approved June 13, 1902, appropriated $20,000 for completing the improvement, and a project for expenditure of amount has been submitted.

PRESENT CONDITION OF CHANNEL.

The channel has been dredged to 26 feet depth at mean low water for its full length and with width extending to within 15 feet of the pier lines on either side. It can not be widened to the pier lines without endangering the pierheads. The middle part, 125 feet wide, has shoaled about 3 feet by deposition of soft mud. The sides, more recently dredged, retain nearly the depth of 26 feet.

PROPOSED OPERATIONS.

The recent appropriation, made for completing the projected improvement, is believed to be sufficient for that purpose, and it will be so applied.

Money statement.

Amount appropriated by river and harbor act approved June 13, 1902 - $20,000.00
July 1, 1902, balance unexpended 20,000.00

Appropriations for improving Gowanus Creek Channel, New York Harbor, have been as follows:

Application.	Date.	Amount.
For previous projects: Parts of the appropriations for Gowanus Bay channels, applied to Gowanus Creek, estimated to amount to about $75,000, dredging to 21 feet depth.	Mar. 3, 1881, to July 13, 1892.	$75,000
For the present project:		
Dredging 26 feet deep	June 3, 1896	25,000
Do	Mar. 3, 1899	25,000
Do	June 13, 1902	20,000
Total		145,000

COMMERCIAL STATISTICS.

No statement of commerce for the past year has been received.

G 5.

ENLARGEMENT OF GOVERNORS ISLAND, NEW YORK HARBOR.

PROJECT FOR WORK.

The sundry civil act of March 3, 1901, contained the following appropriation:

Toward the enlargement of Governors Island, two hundred thousand dollars; and for the erection of storehouses and other necessary buildings, in accordance with the plan reported by a board composed of Major-General John R. Brooke, Colonel George L. Gillespie, and Colonel Amos S. Kimball, dated July twenty-first (August seventeenth), nineteen hundred, sixty thousand dollars; in all, two hundred and sixty thousand dollars.

A project for expenditure of $200,000 of this appropriation, assigned to the Engineer Department, was submitted June 14, 1901, and approved by the Secretary of War July 5, 1901. This approval allotted the funds as follows:

1. Construction of a pile dock and covered wharf on the north shore to communicate with the storehouse proposed to be erected by the Quartermaster's Department, $65,000.

2. Excavating a channel 26 feet deep over the shoal and exterior and adjacent to the dock and wharf, $75,000.

3. Building a crib bulkhead on the west side of Buttermilk Channel, constituting part of the eastern sea wall which is to support the enlargement of Governors Island over the southern shoal.

This project was modified August 22, 1901, by substituting a riprap bulkhead, built to about 2 feet above mean low water, for the crib bulkhead, because borings showed that the bottom was too soft to support crib work without going to great depth and unduly increasing the cost.

It was further modified so as to provide for extending and repairing the old engineer landing near Castle Williams to admit of immediate use for landing of stores by the Quartermaster's Department and save rental of storehouses; and to provide a depth of 15 feet at mean low water at that landing, to be obtained by dredging. The project was again modified April 14, 1902, so as to defer for the present the erection of a steel shed or cover upon the wharf, and to apply the funds intended for that structure, about $35,000, to continuing the bulkhead for enlargement of the island.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1902.

1. Construction of pile wharf.—Upon recommendation of the Quartermaster's Department the general plan adopted was for a T-wharf, with the bridge or approach 40 feet wide and 180 feet long, starting from the north sea wall at a point about 900 feet easterly from the center of Castle Williams, with a T-head parallel to the channel 370 feet long and 50 feet wide. Plans were drawn up in accordance with the latest adopted practice of the New York City Dock Department, and, after advertising for proposals, a contract was entered into with Messrs. Rosevelt & Sullivan, of New York City, for building the wharf. Work was begun December 17, 1901, and under an extension of the contract is now nearly completed. It is in daily use by the Quartermaster's Department, which has laid a railroad track along the wharf and connecting with the large warehouse near by. To complete the wharf there remains only the driving of about 50 fender and dolphin piles, the building of two gangways, and the placing of about 100 feet of backing log. The work has been delayed by difficulty in obtaining white-oak piles of the requisite length.

Eight iron mooring posts and eight cleats were purchased and placed along the wharf, under open market transaction, at a cost of $696.

2. Dredging in front of the wharf.—To provide easy access to the wharf for large vessels, it was decided to dredge 26 feet deep at mean low water along the face of the wharf, extending the cuts 200 feet beyond either end of the wharf, and then deflecting at an angle of 30 degrees, until deep water is reached. Under a formal written contract with the R. G. Packard Dredging Company, work was begun November 22, 1901, and up to June 30, 1902, 69,944 cubic yards of sand, gravel, clay, and bowlders were removed, completing the whole work except a small shoal near its eastern end, and which the contractor's dredge was not able to move. It is expected that this shoal will be removed in July.

The first cut along the face of the dock was made before the dock piles were driven, and was lapped 10 feet over the line for the face of the dock, so that the front piles would be driven in deep water without liability of settling from pressure of the bank.

In parts of the area the bank was of stiff red clay, which would not pass through the doors of the scows. The contractor tried washing the wells of the scow with crude petroleum, but with little success. Afterwards he brought scows to the work with each well containing about 20 yards of soft mud (dredged under a private contract in Atlantic Basin), and this enabled him to dump the clay with comparatively little trouble.

3. Riprap bulkhead.—This consists of a substructure rising to about 2 feet above low water and 12 feet wide on top, on which it is designed ultimately, and after the riprap has settled, to place an upper wall to retain the embankment. After advertising for proposals, a contract was entered into with Brown & Fleming, of New York City, to build the riprap bulkhead, furnishing and placing the stone at the rate of 35 cents per ton of 2,240 pounds. This price represents hardly the cost of freighting and placing the stone; it results from the excavation of the New York City rapid transit subway, where great quantities of stone suitable for this work are taken out and must be gotten rid of at once—a peculiarly favorable condition for the building of this bulkhead.

Work under the contract was begun November 27, 1901, and up to the close of the fiscal year 128,896 tons of stone had been placed, completing 2,430 linear feet of the bulkhead, with 750 feet additional in progress. The entire southeast wall along Buttermilk Channel, 2,230 feet long, is completed up to 2 feet above low water; the southwest wall or cross wall was begun, and operations upon it were suspended to admit of completion of arrangements for a further extension of the proposed enlargement according to plans presented by Messrs. McKim, Mead & White, architects; the northwest wall, along the North River side, is begun, 200 linear feet of it being completed to full dimensions.

By act of the legislature of the State of New York, passed February 27, 1901, a grant of land under water was made conveying to the United States the land to be covered by the bulkhead as originally designed; the extension proposed by the architects can not be built until the grant of land is correspondingly extended.

The wall as built consists of a core of small stones, faced on the outer sides with large stones; it is nearly water-tight and, from careful levels, seems to settle about 2 inches within a month from completion and thereafter to remain undisturbed.

A platform 12 by 12 feet has been built on piles at the outer end of the northwest wall on which a light and fog bell have been mounted. This was done as a precautionary measure to prevent a possible accident, particularly to ferryboats, where the result of any such accident would be very serious, although the work in progress is so well known that it ought to be avoided in any case.

4. Engineer landing.—This small dock near Castle Williams was extended to 9½ feet depth at mean low water, with a landing face 51 feet long, and the area in front of it was dredged to 15 feet depth to meet emergencies requiring the immediate removal of stores to Governors Island. This work was done in September and October, 1901, under two open-market agreements, one for dock repair, filling, and extension, at a cost of $2,850, and one for dredging, at a cost of $3,850.

During the dredging three submarine cables were picked up by the

dredge and considerably injured or broken. Though these cables landed at a dock belonging to the Engineer Department, no permission had ever been asked to land them there and their locations were not known to this office. They were subsequently removed, repaired, and relaid without cost to the Engineer Department.

PROPOSED OPERATIONS.

With the available funds it is proposed to complete the wharf and the dredging in front of it and to extend the riprap bulkhead along the North River side up to the sea wall near Castle Williams.

Future appropriations should be applied to completing the enlargement of the island.

Money statement.

July 1, 1901, balance unexpended	$200,000.00
Amount appropriated by general deficiency act approved July 1, 1902	200,000.00
	400,000.00
June 30, 1902, amount expended during fiscal year	109,493.99
July 1, 1902, balance unexpended	290,506.01
July 1, 1902, outstanding liabilities	29,659.20
July 1, 1902, balance available	260,846.81
July 1, 1902, amount covered by uncompleted contracts	26,822.90
Amount (estimated) required for completion of existing project	625,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902	400,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

The appropriations made for this work are: $260,000 made by the sundry civil act of 1901, of which $200,000 were appropriated for work assigned to the Engineer Department; and $200,000 by the general deficiency act approved July 1, 1902.

CONTRACTS IN FORCE.

Dredging:
- Name of contractor: R. G. Packard Company, 130 Pearl street, New York City.
- Date of contract: October 12, 1901.
- Date of approval: October 30, 1901.
- Date for completion: May 9, 1902.
- Extension of contract: Time of completion waived for a period of two months (authority of Chief of Engineers), or July 11, 1902.
- Quantity: 89,750 cubic yards of material, at 78 cents per cubic yard.

Building pile dock:
- Name of contractor: Rosevelt & Sullivan, 80 New street, New York City.
- Date of contract: October 12, 1901.
- Date of approval: October 25, 1901.
- Date for completion: April 4, 1902.
- Total cost of construction: Approximately $25,362.16.
- Extension of contract: Time of completion waived by authority of Chief of Engineers for a reasonable period.

Building riprap bulkhead:
- Name of contractor: Brown & Fleming, 129 Broad street, New York City.
- Date of contract: November 12, 1901.
- Date of approval: November 27, 1901.
- Date for beginning: December 17, 1901.
- Date for completion: June 16, 1902.
- Quantity: 142,000 tons, at 35 cents per ton.
- Extension of contract: Time of completion waived for two months from June 21, 1902, or August 21, 1902.

G 6.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

1. Wreck in Red Hook Channel off Conover street, Brooklyn.—This wreck lay in about 20 feet of water on the bank of the Red Hook Channel, and had a least depth of 8 feet upon it.

An allotment of $500 was made December 13, 1901, for removal of this wreck. After advertising for proposals, the offer of the Hudson River Lighterage Company to remove the wreck bodily for the sum of $350 and to purchase the hulk and contents for $100 was accepted.

The wreck was removed January 2, 1902, and deposited behind the bulkhead line, aground at high tide, at Edgewater, N. J., at net cost to the United States of $250. It was found to be an old lighter, with no mark by which its name or former ownership could be determined.

2. Barges Lichtenfels Bros., Ringleader, and P. J. Carleton.—The barge *Lichtenfels Bros.*, loaded with soft coal, sunk February 22, 1902, and lay in water 20 feet deep, 1,000 feet west of the Main Ship Channel and in the fair way for sailing vessels.

The barges *Ringleader* and *P. J. Carleton*, also coal laden, sunk early in March, 1902, and lay in water 20 to 25 feet deep, about 6,500 feet southwest from Romer light-house.

These wrecks were abandoned, and the removal was authorized. After inviting proposals, the offer of the Sound and Coast Wrecking Company, of Bridgeport, Conn., to completely remove the *Lichtenfels Bros.* for the sum of $3,900, and the offer of the Merritt & Chapman Derrick and Wrecking Company to completely remove the *Ringleader* and the *P. J. Carleton* for the sum of $14,669 net were accepted. An allotment of $19,500 was made April 28, 1902, to provide for the removal of these wrecks and necessary inspection expenses.

Work was begun soon after. The coal has been removed from the *Lichtenfels Bros.*, the wreck broken up and almost wholly removed. The *Ringleader* has been removed, but not yet finally disposed of. The coal is now being taken out of the *P. J. Carleton.*

3. Schooner Jacob Rivell.—This schooner, with cargo of brick, attempted to cross the shoal south of Governors Island during a thick snow squall about noon of March 5, 1902. She struck the bulkhead, drifted south and lay in water 20 feet deep on the shoal, about 800 feet from the bulkhead. An allotment of $75 was made for the purpose of dragging the wreck behind the bulkhead, but it was found that the vessel had settled so deep into the bottom that it could not be moved without lifting. An additional allotment of $325 was made for her complete removal; and after advertising for offers, the offer of J. F. Baxter, of New York, N. Y., was accepted to remove and dispose of the wreck for the net sum of $146. The wreck was lifted by pontoons May 23, 1902, and the following day was grounded at high water behind the bulkhead line at Weehawken, N. J. An inspection May 31, 1902, showed that it was placed where it would not be liable to escape into navigable waters.

CONTRACTS IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1902.

Under emergency:
For removal of wrecked barge *Lichtenfels Bros.* from New York Harbor.
Name of contractor: The Sound and Coast Wrecking Company, of Bridgeport, Conn.
Date of contract: May 7, 1902.
Date of commencement and completion: Within 8 weeks from date of contract.
Extension of contract: 30 days from July 2, 1902.
Total consideration of contract: $3,945, less $45 for barge and contents, or $3,900 net.
For removal of sunken coal barges *Ringleader* and *P. J. Carleton* from New York Harbor, N. Y.
Name of contractor: Merritt & Chapman Derrick and Wrecking Company, of New York City, N. Y.
Date of contract: May 6, 1902.
Date of beginning: Within 15 days from date of contract.
Date of completion: Within 50 days from date of commencement (Sundays and legal holidays excepted).
Total consideration of contract: $14,725, less $28 for each wreck and their contents, or $14,669 net.

G 7.

MODIFICATION OF HARBOR LINES IN BUTTERMILK CHANNEL, NEW YORK HARBOR, AT ATLANTIC BASIN, BROOKLYN, NEW YORK.

WAR DEPARTMENT,
Office of the Secretary.

[Memorandum for the Chief of Engineers.]

Papers presented by Mr. Charles E. Hotchkiss, representative of the New York Dock Company, regarding change in harbor lines at the Atlantic Basin.

Respectfully referred, by direction of the Secretary of War, to the Chief of Engineers.

M. O. CHANCE,
Private Secretary.

DECEMBER 19, 1901.

LETTER OF MR. JULIEN T. DAVIES.

DAVIES, STONE & AUERBACH,
MUTUAL LIFE BUILDING, 32 NASSAU STREET,
New York, December 16, 1901.

MY DEAR MR. SECRETARY: Allow me to introduce to you Mr. Charles E. Hotchkiss, of our firm, who comes to Washington as the representative of the New York Dock Company, which, you may remember, is the successor of the old Brooklyn Wharf and Warehouse Company.

He will explain to you that this company is now about to improve its water front at the Atlantic Basin and that there is a discrepancy in the harbor lines which it will be greatly to the advantage of the

company as well as to the general public to have rectified. It is impossible to go on with the contemplated improvements at this point until this difficulty has been removed.

Mr. David H. King, jr., is the president, and Mr. Adrian Iselin, jr., is the vice-president of the New York Company. Frederic P. Olcott, Frederic Cromwell, Walter G. Oakman, Jacob L. Greene, George W. Young, and others are directors, and this company owns about 2½ miles of water front on the Brooklyn shore, so that you will see that it is a substantial enterprise.

Thanking you in advance for your kind attention in the matter, I am,

Sincerely, yours, JULIEN T. DAVIES.

Hon. ELIHU ROOT,
Secretary of War.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
December 20, 1901.

Respectfully referred to Col. Chas. R. Suter, Corps of Engineers, for consideration and report by the New York Harbor Line Board.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Third indorsement.]

NEW YORK HARBOR LINE BOARD,
ARMY BUILDING,
New York City, January 16, 1902.

Respectfully returned to the Chief of Engineers, inviting attention to the report of the New York Harbor Line Board of this date.

CHAS. R. SUTER,
Colonel, Corps of Engineers,
President Harbor Line Board.

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
February 20, 1902.

Respectfully returned to the Secretary of War.

The New York Dock Company requests modification of the harbor lines along the water front at the Atlantic Basin, in the city of New York, borough of Brooklyn.

The matter has been referred for consideration by the New York York Harbor Line Board, and inviting attention to the board's report of January 16, 1902, herewith, it is recommended that the modified ›s selected be approved. These lines are indicated upon the accom-ying chart[a] and described in the board's report, and it is further

[a] Not printed.

recommended that the Secretary place his approval upon both the map and the report, which have been prepared for his signature.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

REPORT OF THE NEW YORK HARBOR LINE BOARD.

HARBOR LINE BOARD,
New York City, January 16, 1902.

GENERAL: The New York Harbor Line Board has carefully considered the application of the New York Dock Company for modification of existing harbor lines at Atlantic Basin, New York Harbor, referred to the board for consideration and report by your indorsement of December 20, 1901, and has the honor to submit the following report thereon:

In its report of February 18, 1890, the New York Harbor Line Board, recommending for adoption harbor lines from south pier at Hamilton avenue ferry to Red Hook (Partition street), states that:

The pier head line on this front was recommended by the special board in their report to the governor of the State of New York, dated May 5, 1875, and was enacted by chapter 491, act of legislature of the State of New York, passed June 6, 1884. (For copy of act see paragraph 7, page 13.)

The bulkhead line on this front was adhered to by the New York harbor commissioners January, 1857, as established by chapter 268, act of the legislature of the State of New York, passed May 28, 1841, which is described as follows: * * *

At that time the Board adhered to the line of 1841 under the assumption that it was coincident with the face of the bulkhead of Atlantic Basin as built, and which was believed to be identical with the pierhead and bulkhead line described in the report of the New York Harbor Commissioners of 1857, but which line was not drawn upon their maps. The maps which were at that time available by the Board apparently confirmed the view that the line of 1841 was coincident with the face of the bulkhead as built. It is now shown by the maps of the Department of Docks and Ferries of the City of New York, issued in 1899, that the harbor line of 1841 which was approved by the Secretary of War, March 4, 1890, cuts the bulkhead of Atlantic Basin near Hamilton avenue by about 12 feet, which is the maximum.

The modified harbor lines which the Board now recommends for the locality, clear the existing bulkheads and are extended toward the river from zero at the southerly end of the new lines to about 30 feet at Hamilton avenue.

A tracing is forwarded herewith showing the modified lines now recommended for approval. These new harbor lines are described as follows:

The bulkhead line begins at a point in the westerly prolongation of the northerly side of Coffey (formerly Partition) street, 845 feet from the westerly side of Ferris street; thence northeasterly in a straight line to a point in the westerly side of Hamilton avenue, produced, northerly, 140 feet from the northerly side of Pier North; thence southerly in a straight line along the westerly side of Hamilton avenue, produced, until it meets the bulkhead line approved by the Secretary of War, March 4, 1890.

The pier head line along this front, which is practically identical with the pier head line approved by the Secretary of War March 4, 1890, coincides with the

bulkhead line to a point 1,200 feet southwesterly from the terminal point in the westerly side of Hamilton avenue, produced northerly, 140 feet from the northerly side of Pier North: thence the pier head line departs from the bulkhead line and continues in a straight line to the terminal point of the pier head line approved by the Secretary of War November 17, 1897, said point being in the westerly prolongation of a line perpendicular to the north side of Pier North 279 feet therefrom and 23.5 feet west from the westerly side of Hamilton avenue.

Respectfully submitted.

CHAS. R. SUTER,
Colonel, Corps of Engineers.
S. M. MANSFIELD,
Colonel, Corps of Engineers.
W. L. Marshall,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. Army.

WAR DEPARTMENT,
February 24, 1902.

Approved.

WM. CARY SANGER,
Assistant Secretary of War.

G 8.

MODIFICATION OF HARBOR LINES AROUND SHOOTERS ISLAND, NEW YORK HARBOR, NEW YORK.

NEW YORK, *January 23, 1902.*

DEAR SIR: We hereby respectfully apply to the War Department for permission to extend launching slips and staging piers on south side of our shipyard, Shooters Island, New York, to the yellow line between the points marked by arrows "A" and "B," on plans submitted herewith.

We also respectfully request your Department to extend the boundary lines of bulkheads and piers on south and westerly sides of Shooters Island, to conform to the yellow line shown on accompanying plans.

Yours, respectfully,

THE TOWNSEND AND DOWNEY SHIPBUILDING AND REPAIR CO.,
WALLACE DOWNEY, *President.*

Hon. ELIHU ROOT,
Secretary of War.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
January 29, 1902.

Respectfully referred to Col. Charles R. Suter, Corps of Engineers, president New York Harbor Line Board, for report.

To be returned.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Third indorsement.]

NEW YORK HARBOR LINE BOARD,
ARMY BUILDING,
New York City, March 24, 1902.

Respectfully returned to the Chief of Engineers, inviting attention to the report of the New York Harbor Line Board of this date.

CHAS. R. SUTER,
Colonel, Corps of Engineers,
President of the Board.

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
March 27, 1902.

Respectfully returned to the Secretary of War.

Modification of the established harbor lines around Shooters Island, New York Harbor, is requested by the Townsend-Downey Shipbuilding and Repair Company.

The matter has received consideration by the New York Harbor Line Board, to whose report of the 24th instant attention is respectfully invited.

It is recommended that the modified line selected by the Board be approved, and that the Secretary place his approval upon both the report and the accompanying tracing,[a] which have been prepared for his signature.

The modified lines recommended are substantially the same as those indicated by the company in its application.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

NOTE.—The lines referred to above and shown on the map mentioned were approved by the Secretary of War, under date of March 29, 1902, the approval being indicated on the map.

REPORT OF THE NEW YORK HARBOR LINE BOARD.

HARBOR LINE BOARD,
New York City, March 24, 1902.

GENERAL: The New York Harbor Line Board has the honor to submit the following report on the application of the Townsend and Downey Shipbuilding and Repair Company for extension of existing harbor lines around Shooters Island, N. Y., which was referred to the Board for report by your indorsement of January 29, 1902.

This application seems to have been made for the purpose of adapting the harbor lines to the actual constructions existing at Shooters Island January 4, 1890, when the original lines for that locality were approved by the Secretary of War, and for the additional purpose of avoiding broken lines. Part of the bulkhead lines approved in 1890 were drawn within the actual lines of solid filling then existing, and after careful consideration of this matter the Board now recommends

[a] Not printed.

that the present lines be modified as shown on a tracing which accompanies this report. If the proposed modification is approved by the Secretary of War, it will be substantially equivalent to the granting of the application of the Townsend and Downey Shipbuilding and Repair Company, as well as legalizing the actual constructions now existing and in place January 4, 1890.

The lines recommended for adoption are described as follows:

PIERHEAD LINE.

Beginning at a point on the southerly side of Shooters Island, marked A on the accompanying map, coincident with the point similarly marked on the map showing the harbor lines around Shooters Island, approved by the Secretary of War January 4, 1890; also coincident with the point mentioned in the description of the grant of land under water granted by the State of New York under dates of June 12 and July 5, 1879; thence easterly in a straight line bearing S. 80° 39′ 20″ E. 156.56 feet; thence easterly in a straight line bearing S. 88° 9′ 38″ E. 1,294.4 feet; thence northerly in a straight line along the pierhead line approved by the Secretary of War January 4, 1890, bearing N. 5° 54′ E. 944 feet; thence westerly in a straight line along the pierhead line approved by the Secretary of War January 4, 1890, and 70 feet beyond, bearing N. 65° 20′ W. 1,870.46 feet; thence southerly in a straight line bearing S. 3° 56′ 49″ W. 1,448.08 feet; thence southeasterly in a straight line bearing S. 50° 41′ 40″ E. 328.5 feet to the point and place of beginning.

BULKHEAD LINE.

Beginning at the aforesaid point in the pierhead line marked A; thence southeasterly coincident with the pierhead line in a straight line bearing S. 80° 39′ 20″ E. 156.56 feet; thence easterly in a straight line bearing S. 88° 9′ 38″ E. 1,294.4 feet; thence northerly in a straight line bearing N. 5° 54′ E. 135 feet; thence the bulkhead line departs from the pierhead line and continues westerly along the bulkhead line approved by the Secretary of War January 4, 1890, in a straight line bearing N. 88° 44′ W. 600 feet; thence northerly in a straight line bearing N. 5° 54′ E. 426.98 feet; thence northwesterly in a straight line bearing N. 65° 20′ W. 957.34 feet; thence southwesterly in a straight line bearing S. 72° 02′ 40″ W. 260.5 feet; thence the bulkhead line joins the modified pierhead line and continues southerly coincident with the pierhead line in a straight line bearing S. 3° 56′ 49″ W. 617.99 feet; thence southeasterly in a straight line bearing S. 50° 41′ 40″ E. 328.5 feet to the point and place of beginning.

The bearings quoted in the above description refer to the magnetic meridian of 1872, which varied west 7° 56′ from the true meridian.

Respectfully submitted.

CHAS. R. SUTER,
Colonel, Corps of Engineers.
S. M. MANSFIELD,
Colonel, Corps of Engineers.
W. L. MARSHALL,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. Army.

G 9.

MODIFICATION OF HARBOR LINES AT ELLIS ISLAND, NEW YORK HARBOR, NEW YORK.

TREASURY DEPARTMENT,
OFFICE OF THE SECRETARY,
Washington, December 7, 1900.

SIR: Under date of May 14, 1900, this Department had the honor to address a communication to you, relative to the efforts which were

then being made by one Edwin F. Cragin to secure permission to construct an island between Ellis Island and Bedloe Island, New York Harbor, for the purpose of erecting thereon certain wharves, storehouses, etc. Copies of papers and a map showing the proposed location of said island, etc., were inclosed with said letter, and this Department requested that before favorable action was taken by your Department in reference thereto, this Department be accorded an opportunity to be heard in reference to its needs in connection with the branch of the United States Immigration Service to be put into operation on Ellis Island, upon the completion of the buildings, etc., now in course of construction thereon.

This Department has now in contemplation the further enlargement of Ellis Island by the construction of an addition to the new or southwest portion of said island, 800 by 410 feet, as shown on the accompanying plat. It is proposed to utilize said addition for the erection of a United States marine hospital, and for the purposes of the United States Marine Hospital Service.

I have the honor to transmit herewith a tracing[a] showing the location and extent of said proposed addition to Ellis Island, and to request that you will, under the provisions of the act of Congress, entitled "An act making appropriation for the construction, repair and preservation of certain works on rivers and harbors, and for other purposes," approved March 3, 1899, issue such authorization as may be necessary for this Department to use so much of New York Harbor as may be required for the purpose of making the proposed extension to Ellis Island.

As the enlargement of Ellis Island as contemplated in the foregoing application will encroach upon the territory embraced in the plans of the syndicate hereinbefore referred to, and as the proximity of any other island or structure within a distance of 500 feet from Ellis Island would be objectionable, and defeat the very object for which the United States immigration service at New York City has been isolated, it is requested that preference be given by your Department to the foregoing application, and that no favorable action be taken by your Department upon the application of said syndicate, or other person or corporation who may seek to place any construction of any kind in proximity to Ellis Island, without giving this Department an opportunity to be heard in opposition thereto.

Respectfully,

L. J. GAGE, *Secretary.*

The SECRETARY OF WAR.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
December 22, 1900.

Respectfully referred to Col. Henry M. Robert, Corps of Engineers, for consideration and report by the New York Harbor Line Board.

To be returned.

By command of Brig. Gen. Wilson:

A. MACKENZIE,
Lieut. Col., Corps of Engineers.

[a] Not printed.

[Third indorsement.]

NEW YORK HARBOR LINE BOARD,
ARMY BUILDING,
New York City, January 29, 1901.

Respectfully returned to the Chief of Engineers, inviting attention to report of this date.

HENRY M. ROBERT,
Colonel, Corps of Engineers,
President of the Board.

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
February 1, 1901.

Respectfully returned to the Secretary of War.

Application is made by the Secretary of the Treasury for permission to enlarge Ellis Island in New York Harbor, as shown on accompanying tracing, for the erection of a United States marine hospital and for use of the United States Marine-Hospital Service.

The matter has been investigated by the New York Harbor Line Board, whose report of the 29th ultimo is herewith.

The bearing of this application upon a pending application of Mr. Edward F. Cragin for permission to build an island between Ellis and Bedloe islands has received full consideration and the Board concludes that the public interests are paramount and that Ellis Island should be extended as far as required for public purposes, even though the Secretary of War decide to permit the building of an island between it and Bedloe (Liberty) Island.

The granting of the within request involves the modification of existing harbor lines, and the Board recommends that the harbor line be modified by extending the pier-head line and bulkhead line on the northwesterly side of the island 410 feet in a southwesterly direction, thence 1,125 feet in a line at right angles to the last line, thence 410 feet at right angles to the last line until it unites with the present pier-head and bulkhead line on the southeasterly side of the island.

The modified line is shown in brown on the accompanying map[a] and is recommended for approval.

The map has been prepared for the signature of the Secretary.

A copy of a letter[a] of January 29 from Mr. Cragin, requesting that action in this matter be held in abeyance, and a letter[a] of January 30 by Colonel Robert for the Board in regard to the same are also herewith.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

NOTE.—The lines referred to above and shown on the map mentioned were approved by the Secretary of War under date of July 1, 1901, the approval being indicated on the map.

REPORT OF THE NEW YORK HARBOR LINE BOARD.

HARBOR LINE BOARD,
New York City, January 29, 1901.

GENERAL: The New York Harbor Line Board has the honor to submit the following report on your reference of December 22, 1900, of the letter to the Secretary of War from the Secretary of the Treasury,

[a] Not printed.

dated December 7, 1900, relative to the further enlargement of Ellis Island, New York, by the immigration service for the erection of a marine hospital, this same having connection with the application of Edward F. Cragin for permission to construct an island between Ellis and Bedloe islands, which latter matter is still under consideration by the Board.

Since the receipt of the above-mentioned letter the Board has given hearings in this matter to Mr. Cragin and also to Mr. Amasa Thornton, the latter of whom states that he is equally interested with Mr. Cragin, and that he represents in all about two-thirds of the interests covered by Mr. Cragin's application. They both strongly oppose any extension of Ellis Island that will interfere with the granting of their request.

A public hearing was given in the Cragin matter on June 14, 1900. At the request of Mr. Cragin the hearing was adjourned until he could prepare some definite plans and submit additional evidence of the public need of the proposed improvement.

During this hearing Mr. Cragin stated that he thought two months would suffice for this purpose. Seven months have passed and now he states that the surveys have been completed and that he will be ready in a few days for another hearing. He requested the Board to defer action on the request of the Secretary of the Treasury for extension of Ellis Island so that both applications could be acted upon at the same time.

The Board has given mature deliberation to the application of the Treasury Department and is unanimously of the opinion that the public interests are paramount, and that Ellis Island should be extended as far as required for public purposes, even though the Secretary of War decides to permit the building of an island between it and Liberty Island, as applied for by Mr. Cragin.

To cover the request of the honorable Secretary of the Treasury, the Board is of the opinion that it is best to move the present harbor line on the southwesterly side of the island 410 feet southwesterly, retaining the rectangular shape of the island.

The Board therefore recommends that the harbor lines around Ellis Island be modified by extending the pier and bulkhead line on the northwesterly side 410 feet in a southwesterly direction; thence 1,125 feet in a line at right angles to the last line; thence 410 feet in a line at right angles to the last line, until it unites with the present pier and bulkhead line on the southeasterly side of the island.

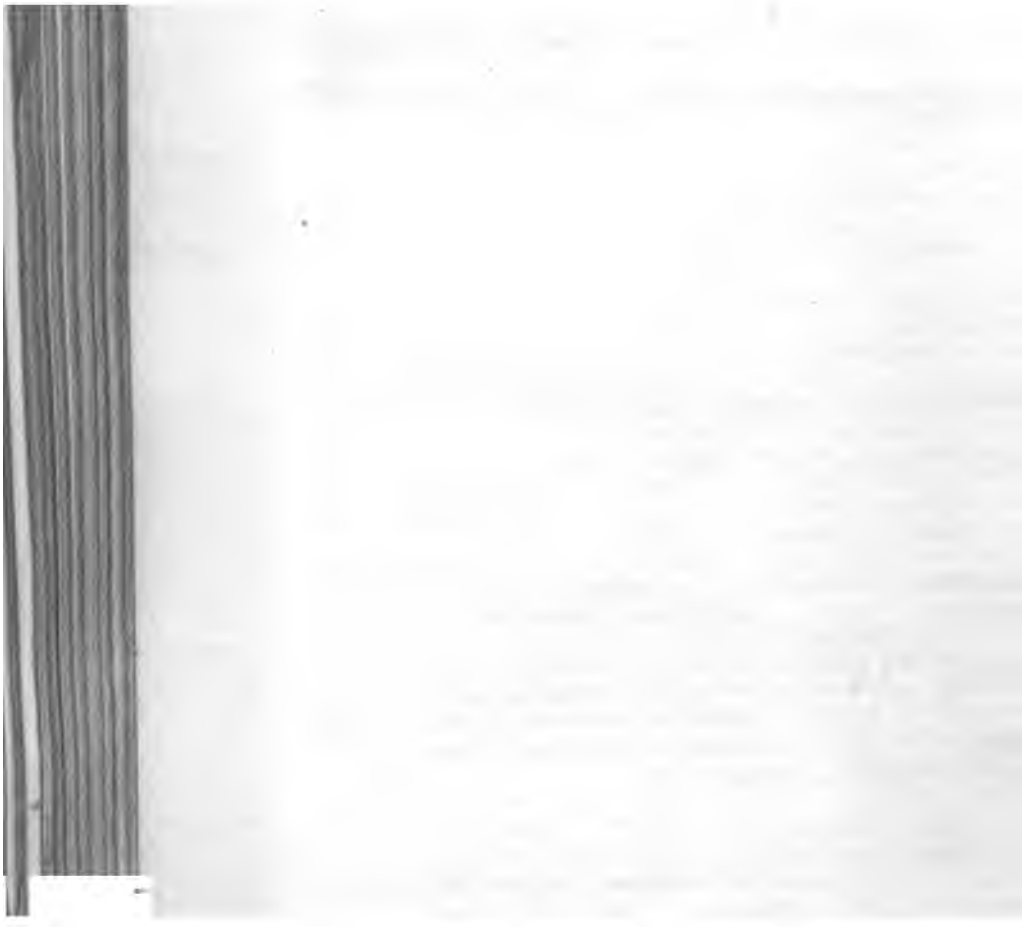
Accompanying this report is a chart[a] showing the modified pier and bulkhead lines around Ellis Island as recommended for approval.

Respectfully submitted.

HENRY M. ROBERT,
Colonel, Corps of Engineers.
J. W. BARLOW,
Colonel, Corps of Engineers.
G. L. GILLESPIE,
Colonel, Corps of Engineers.
E. H. RUFFNER,
Major, Corps of Engineers.
W. L. MARSHALL,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. Army.

[a] Not printed.



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